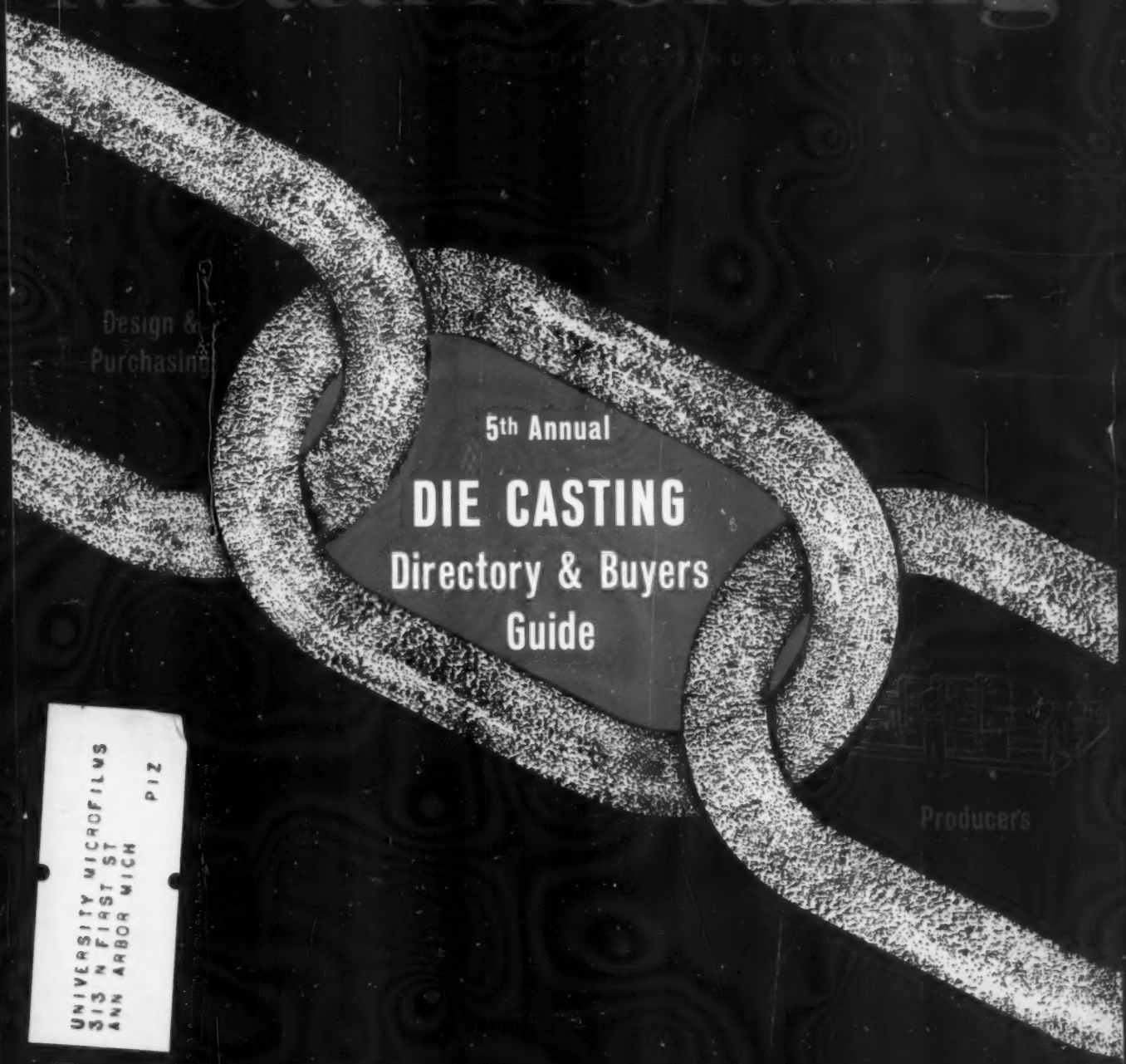
JANUARY 1961

Precision Metal Molding



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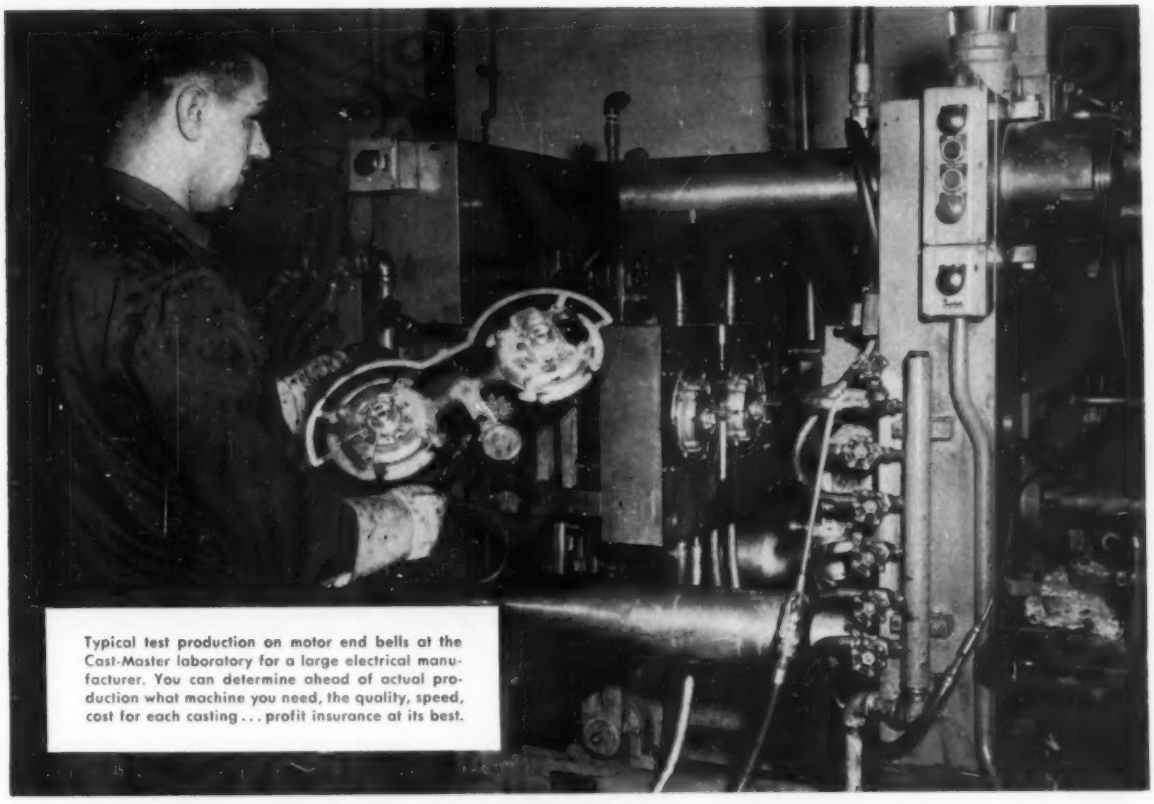

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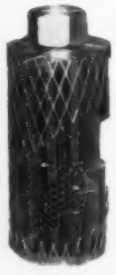
A

A—Synclinal SUMP TYPE
CAPACITIES: 5—8—10—20—30—50—75 and 100 G.P.M.
PIPE SIZES: ¾"—1"—1¼"—1½"—2"—2½" and 3".
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not available.

B—Synclinal LINE TYPE
CAPACITIES: 5—8—10—20—30—50—75 and 100 G.P.M.
PIPE SIZES: ¾"—1"—1¼"—1½"—2"—2½" and 3".
BY-PASS VALVE: Not available.
OPERATING PRESSURES: Up to 80 p.s.i.

B

C—Bonded LINE TYPE
CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1"—1¼"—1½"—2" and 2½".
BY-PASS VALVE: Available with or without.
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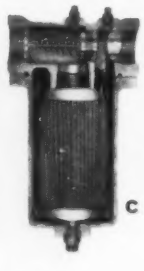
OPERATING TEMPERATURES up to 300° F.

D—IN-LINE FILTER
CAPACITIES: Up to 60 G.P.M.
PIPE SIZES: ¾"—1"—1¼" and 1½" (at both inlet and outlet).
BY-PASS VALVE: Available with or without.

E—Bonded SUMP TYPE
CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1"—1¼"—1½"—2" and 2½".
CONNECTIONS: Coupling—"O" Ring—Male Nipple.
BY-PASS VALVE: Available with or without.

F—Tandem SUMP TYPE
CAPACITIES: 10—16—20—40—60—100—150 and 200 G.P.M.
PIPE SIZES: ¾"—1"—1¼"—1½"—2"—2½" and 3".
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not available.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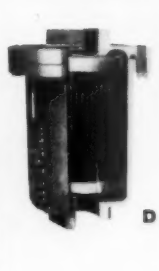
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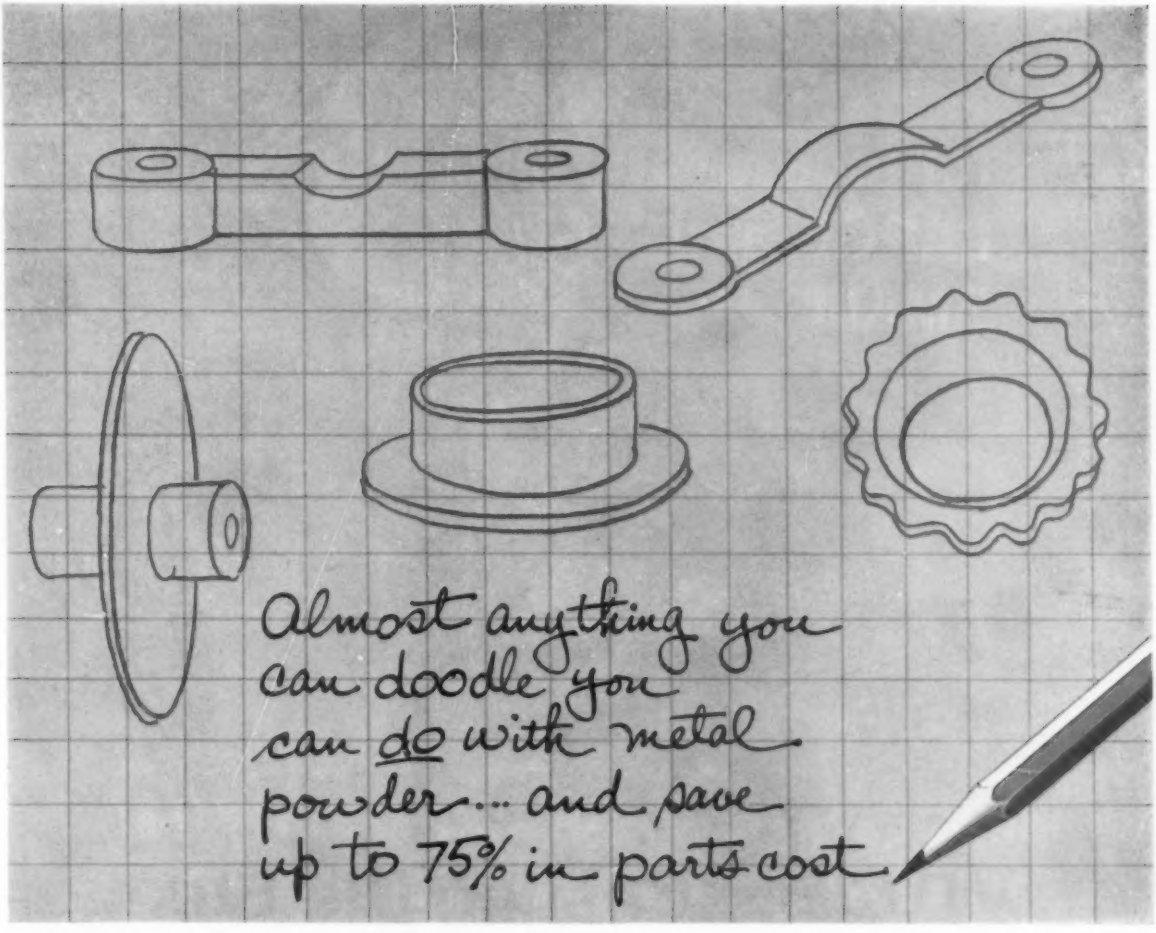

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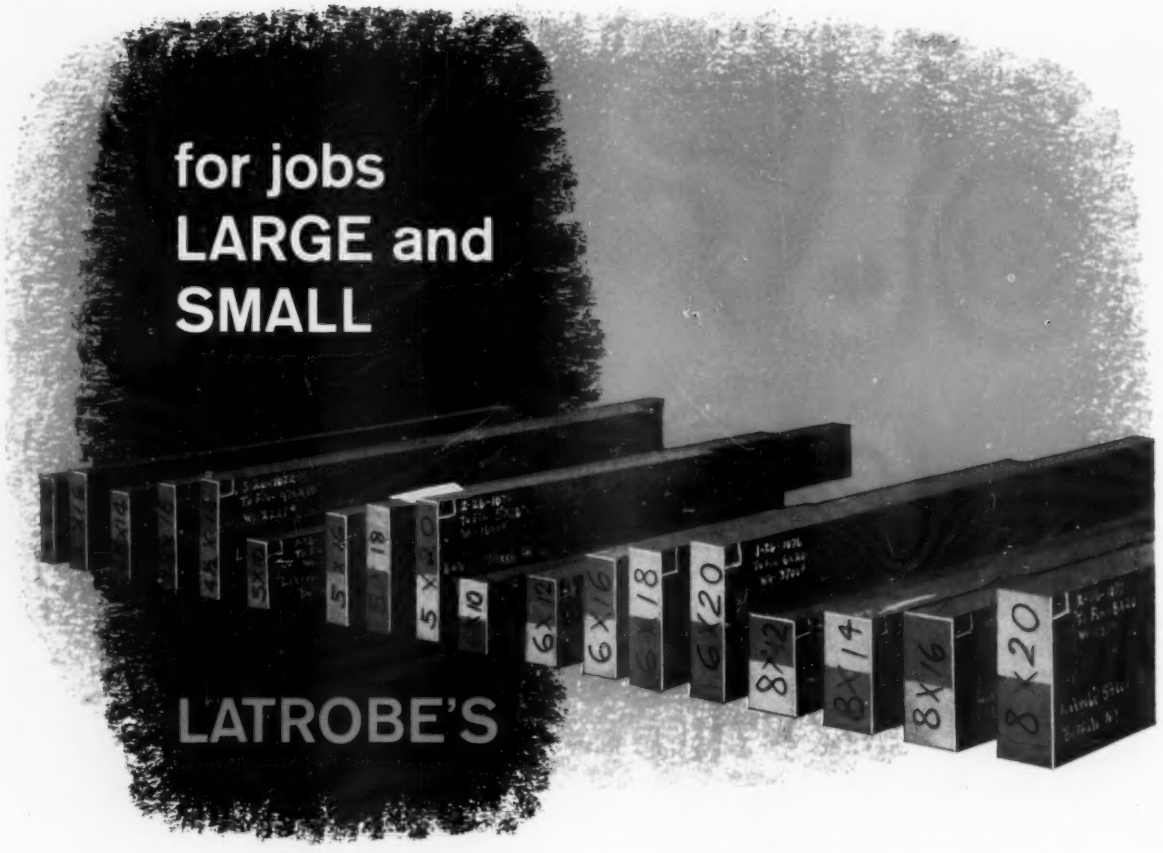

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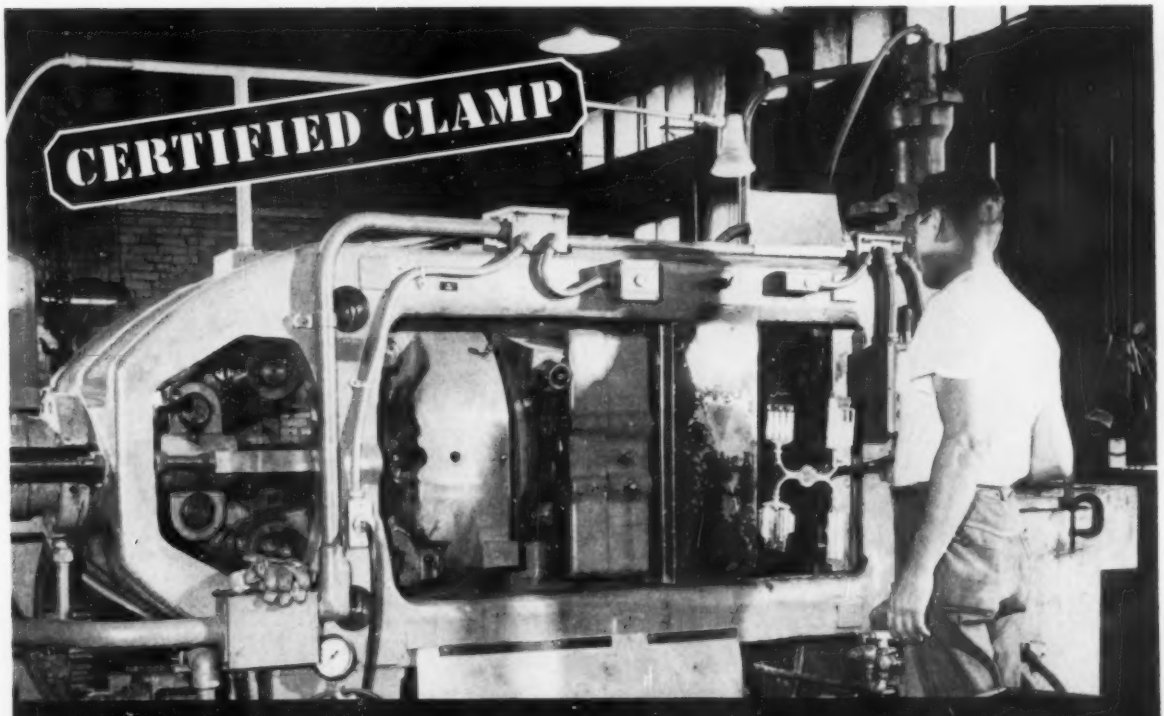

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To achieve this at Sunnen they can use the full fluidity of the metal—to make maximum use of the property potentials of the metal—because the HP-2½-SF Lester which they use has a full 400 tons of CERTIFIED clamp. It will hold any of their dies—from long vertical dies and large gage housing dies to four-unit interchangeable dies for highly detailed and intricate small parts —and where close functional casting dimensions are required, hold them all with a maximum ± .001″ die closing tolerance.

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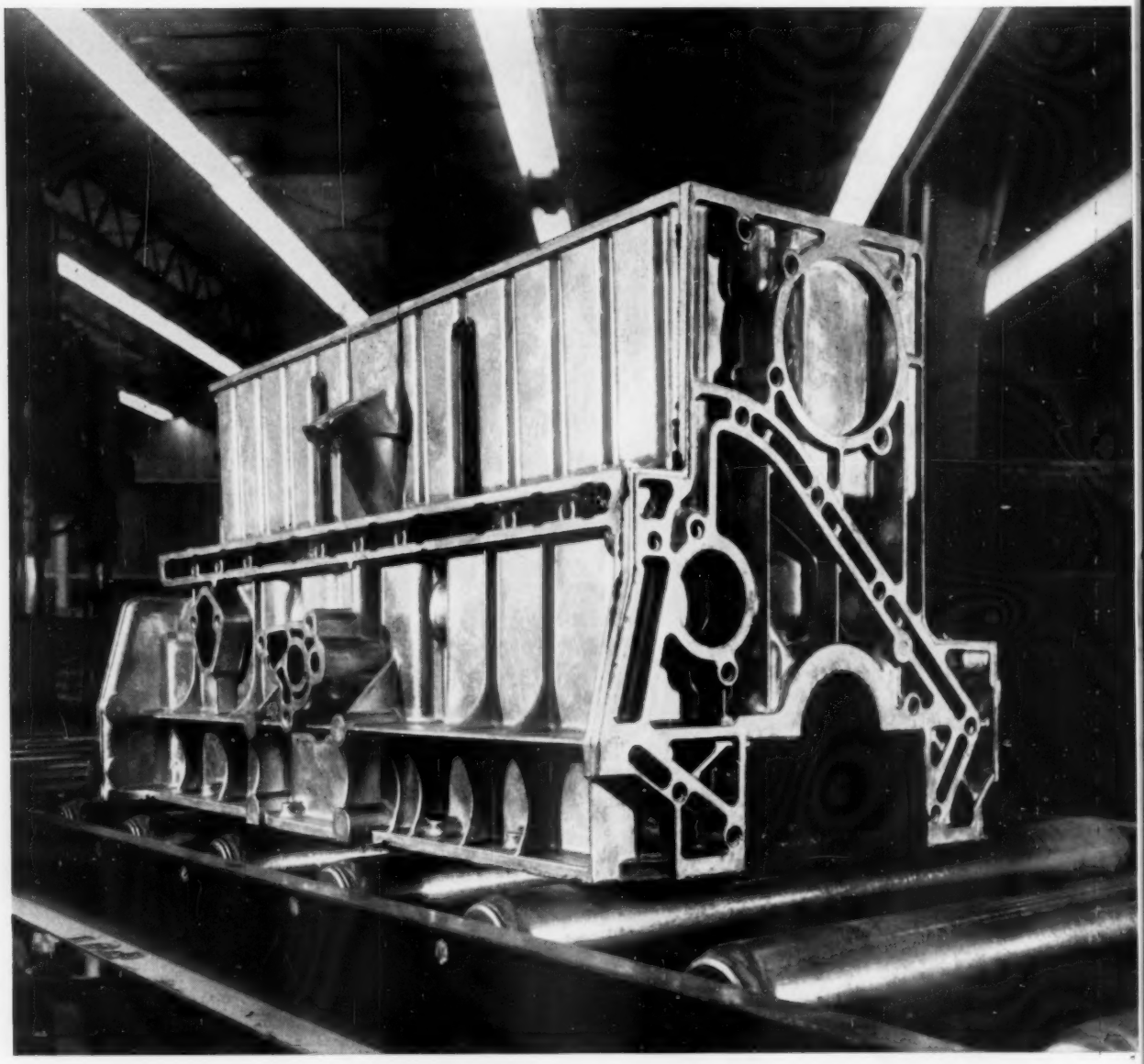


World's first die-cast aluminum "six"

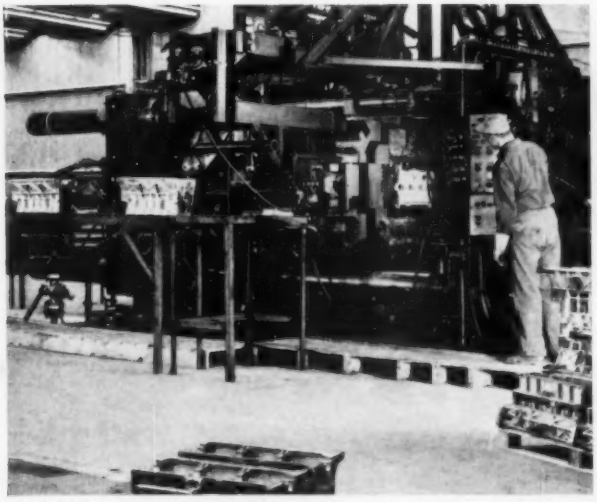
Saves 80 pounds for American Motors' new Rambler Classic . . . incorporates specially bonded cast iron liners in dry sleeve design.

This engine block is the biggest die casting ever mass produced. It's the world's first six-cylinder block for passenger car use to be die cast in aluminum.

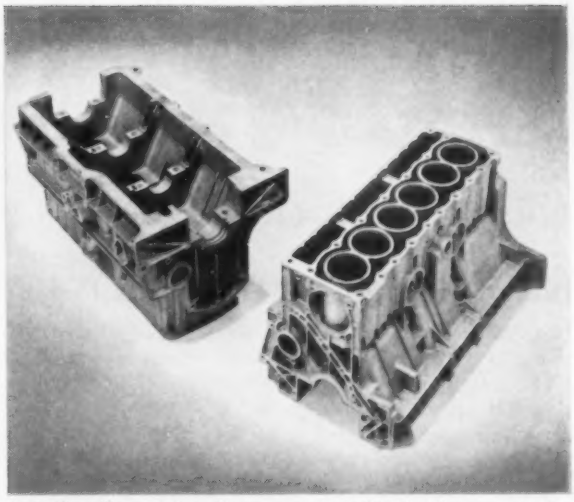
It's a 67 pound lightweight including 14 pounds of centrifugally cast iron cylinder liners. That means a total saving of 80 pounds deadweight . . . now standard in the new Rambler customs, optional in other Rambler models.

Light but strong. Aluminum's excellent physical properties are fully utilized by careful die cast design and photostress analysis. Outstanding strength, soundness and precision provide a big plus for heavily-emphasized Rambler quality.

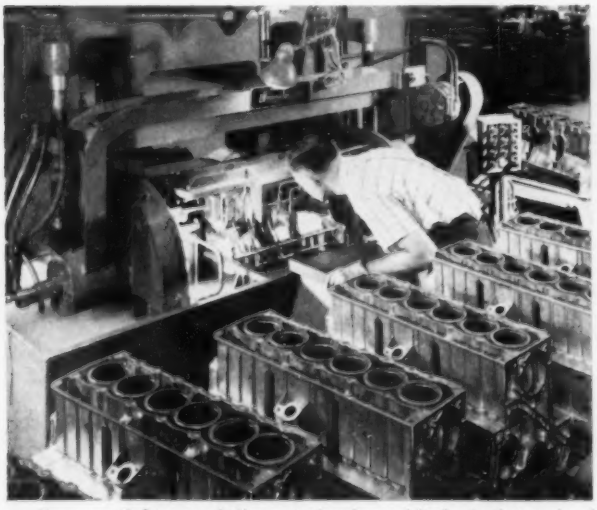
BMI bonding is simple and sure. The BMI—or Bi-Metallic Interlock developed by Doehler-Jarvis—mechanically "anchors" the liners by means of their specially prepared cast surfaces. Since these liners are centrifugal castings, no knurling, crimping or splining is needed. An intimate locking action occurs as the molten aluminum is injected into the die . . . under 8,000 psi. The result: an inseparable bond with excellent heat-transfer properties.



A block every three minutes . . . from 2,000 ton machines like this. In three tenths of a second, machine injects a 70-pound "shot" of molten aluminum . . . under 8,000 psi.



Centrifugally cast iron liners—up to 260 Brinell—are cast in place with specially prepared surfaces which lock inseparably with molten metal under pressure.



Pressure tightness of die-cast aluminum blocks is determined by testing on a machine specifically designed for this purpose. Advanced quality control helps protect highest standards.

Palletized for rapid delivery, these finished blocks can reach American Motors assembly plants by rail . . . or in trucks of the Doehler-Jarvis fleet.

rolls off the line at Doehler-Jarvis

To design for efficient production, American Motors and Doehler-Jarvis engineers combined specialized know-how with liberal imagination. An oil gallery for hydraulic valve lifters is an integral part of the block casting. Liner inserts and loose pieces for casting undercuts are placed by automatic attachments that never slow down the casting cycle.

To make new ideas pay off, perhaps you can use the facilities, resources and practical experience offered by Doehler-Jarvis. Eight plants provide the capacity—and the flexibility—to serve large companies well, and to help small ones grow. For detailed information, simply phone or write the nearest Doehler-Jarvis plant or office.

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Circle No. 31 on Reader Service Card

PMM

casting about *technical news of applications & processes involving precision metal molding*

NEW ALLOYS MAY HELP PUT MEN IN SPACE

The United States will move a step closer to putting a man into space if a proposed new combination of metal alloys is found to resist the intense heat of re-entry.

Molybdenum and columbium alloys will be used in vehicle re-entry tests by Wright Air Development Division, General Electric, and McDonnell Aircraft.

The tests, in which an airframe section of a typical glide re-entry vehicle will be fabricated, will simulate re-entry heating conditions on the molybdenum and columbium alloys.

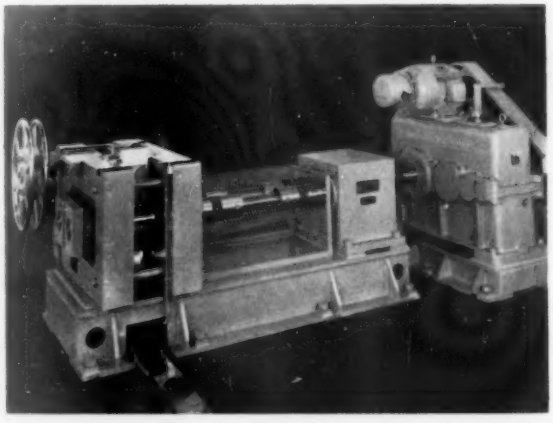
Significant performance improvements have been made in the superalloy of nickle, iron, and cobalt recently. However, their relatively low melting temperatures limit their use to untressed parts at temperatures under 2,000°F, according to a report from Wright.

NEW MILL PRODUCES NICKEL STRIP FROM POWDER

The Naeser-Zirm powder rolling method of thin-gage strip production has been brought within reach of the smaller metal fabricator and pilot plant by the development of a new compacting mill. Built by the Loma Machine Manufacturing Co., the mill is well suited to the production of nickel strip.

Fine metal powder is continuously fed into the mill through a hopper equipped with flow controls. Green strip leaves the mill on an exit chute at speeds varying from 12.5 to 50 ft. per minute. The strip is passed continuously into a protective atmosphere sintering furnace.

It is then given a reduction on a two-high hot mill and then passes on to a four-high cold mill of conventional design. The purity of the strip is limited only by that of the original powder 99.9% purity is obtainable.



STUDY EFFECTS OF ULTRA-HIGH PRESSURES

Pressures over 2,000,000 psi at temperatures over 3,000°C are being used to study the effects of ultra-high pressures and temperatures on various materials. In a paper presented before the 53rd Annual Meeting of the American Institute of Chemical Engineers, William G. Field reported on how current high pressure research promises to be of great value to science and industry.

High pressure has been available for some time, but its usefulness has been limited by the temperature range which could be utilized. Now, newer equipment not only produces extremely high pressures, but also permits the application of temperatures over 3,000°C at these pressures.

Ultra-high pressure is capable of causing marked changes in the properties of matter. It can also affect the possibility and speed of various reactions. When solids with a definite crystal structure are subjected to high pressure, it is possible to force the atoms into a new arrangement or phase. In some materials, such as bismuth, eight different atomic arrangements can be produced.

When the most compact atomic arrangement has been obtained, the atom itself can be deformed. Then it is possible to free electrons and produce effects such as changing non-conductive materials into conductors.

Two new materials, previously unknown, have been created by ultra-high pressures. These are a cubic form of boron nitride, Borazon, and a very dense form of silicon dioxide, Coesite.

High pressure can be used to harden metals in the same manner as temperature. It can also be used to control the type and characteristics of grain structure.

Fields noted that the future of this field depends upon the development of high pressure equipment, techniques, and methods to determine material properties at high temperature and pressure.

NEW CLEVELAND
Model 100 Die Casting Machine

IT'S TOPS IN THE 100-TON CLASS!

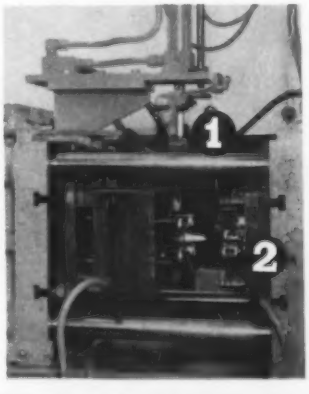
Many unique design features make this new 100-ton Cleveland tops in its class! With both the shot and die closing cylinders operated from the accumulator bottle, the Model 100 cycles well over 1000 shots per hour, depending on the type, size and complexity of casting. It is available any way you want it—as a standard, or automated, hot chamber machine; as a standard cold chamber machine; or as a cold chamber machine equipped with the Morton system of vacuum die evacuation, with or without automatic ladling.

The furnace mounts on casters so that it can be rolled away from the machine to remove the pot. In the operating position, locks on the casters prevent movement of the furnace. Note the minimum piping! Space is provided in the base of the machine for installing a single-unit water box and conveyor that will deliver castings to a bin or conveyor at the pump end of the machine. For hot or cold chamber casting, the machine is designed for two-position shot injection.

Most attractively priced, the new Model 100 gives you every modern feature, plus proven Cleveland dependability, for fast production of small size, hardware finish castings. Write direct, or call in a Cleveland field engineer, for full details.

MAJOR SPECIFICATIONS:

Size of Die Plates	22" x 23"
Die Thickness	19" max., 4" min.
Platen Thickness	3¾"
Tie Bar Dia.	2½"
Motor Hp.	15
Pump Capacity	22 gpm @ 1000 psi
Oil Reservoir Capacity	60 gal.
Shot Capacity	2.6 lbs. aluminum; 4.2 lbs. zinc with standard plungers. Other capacities with other size plungers.
Clamping Capacity	100 ton, strain gauge tested.



The Model 100 Cleveland can be automated to include such features as (1) stripper for removing the casting from the die; (2) automatic die lubrication, as well as low pressure die closing, water box and conveyor, automatic machine lubrication.

Sales Offices: Chicago • Cleveland • Detroit • Hartford • Springfield, N. J.

CLEVELAND AUTOMATIC MACHINE COMPANY
4952 Beech Street • Cincinnati 12, Ohio

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Circle No. 22 on Reader Service Card

HIGH GRADE • INTERMEDIATE • BRASS SPECIAL

Now!

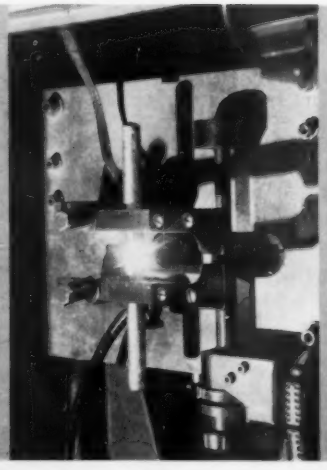
ST. JOE

▶ New Member Of The Famous Line of St. Joe Metals

▶ Developed By ***Research***—

Guarded By Stringent ***Quality Control***

Sample To Complete Analysis in 10 Minutes



To maintain St. Joe zinc's unmatched purity on a continuous basis, an operator casts samples (shown 1/5 actual size) and sends them via air tube to the Baird-Atomic Direct Reading Spectrometer. There a technician places the samples in the Spectrometer's electrode holders. Extremely high voltage creates an arc across the electrodes. As elements are vaporized, light from the arc is broken into element lines of varying light energy.

. . . And This Is How It's Done

This energy, directed to photomultipliers (photo-sensitive electronic tubes), is converted to electrical energy which actuates pre-calibrated dials that indicate elements directly IN PERCENTAGES! In five minutes the zinc sample can be completely analyzed for iron, lead, cadmium, copper, aluminum, indium, tin, antimony, silicon and magnesium. Two minutes later by return tube casting room operators know whether or not they are holding critical purity specifications.

• PRIME WESTERN • "TAILOR-MADE" GRADES

ZINC

99.99+%

St. Joe's modern research laboratories developed the process — St. Joe's rigid, scientific quality control maintains consistent guard over the product — St. Joe 99.99+% Zinc.

Every shipment of St. Joe 99.99+% Zinc is backed by St. Joe's reputation of nearly a century as a supplier of quality metal to American Industry. Consistent metal from St. Joe means consistent results in die-casting.

ST. JOSEPH LEAD COMPANY

ST. JOE

250 PARK AVENUE NEW YORK 17, N. Y.

"the HITCHINER way..."

...and

non-machinable

super alloys

in

INVESTMENT CASTING

These spray nozzles for highway striping paint sprayers were formerly machined out of cold rolled bar stock. When ordinary paint was used, these nozzles functioned satisfactorily. However, when ground glass was added to the paint for reflecting purposes excessive wear caused frequent replacement.

By "the HITCHINER way . . .", we were able to engineer the manufacture of this part by investment casting in a non-machinable type alloy exhibiting a very high degree of resistance to both wear and corrosion.

This change of alloy, which eliminated the need for frequent nozzle replacement, was made possible through investment casting because the required close dimensional tolerances and detail could be cast to size.

Through the wide freedom of choice in alloy, as well as through flexibility in design and the elimination of expensive machining operations, investment casting may possibly solve your metal parts manufacturing problems. Send us your sample or blueprint and find out with a Hitchiner "engineered quotation" — no obligation.

NO LIMITATIONS. From miniature ball bearing races to 20" Steam Turbine Impellers, "the Hitchiner way . . ." with investment castings can help you.

Send for our latest revised brochure and find out for yourself. It's free.

HITCHINER

MILFORD 28, NEW HAMPSHIRE

Coast to Coast Engineering Representatives

Circle No. 40 on Reader Service Card

PMM letters

the readers' forum

OIL FILTERS

It is our understanding that external oil filters are now available for die casting machines.

If you are aware of the manufacturers of these filters, we shall appreciate receiving their names in order that we may contact them. —P.H.

There are at least two companies who manufacture the type of filter inquired about. These are: Marvel Engineering Co., 7227 Hamlin Ave., Chicago 45, Ill. and Mayhew Products Co., 5316 Santa Fe Ave., Los Angeles 58, Calif.—Ed.

DIE CAST LOUVERS

In your September issue is an article indicating that the Electra Jets are utilizing die cast louvers. We would appreciate it very much if you could give us the name of the supplier who furnishes these parts to Lockheed Corp.

We may have an application for a standard aluminum louver as indicated by your articles, providing it can be supplied economically to our apparatus.—P.S.D.—Specialist, Materials Eng.

The louvers described in the article in the September issue were made by the Los Angeles Die Casting Co., 340 Crocker St., Los Angeles, Calif.—Ed.

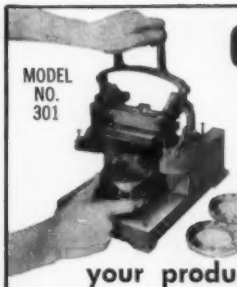
SMALL DIE CASTING MACHINES

We are trophy manufacturers and have been pouring our lead alloy castings (linotype metal) in two or more part molds held together with a "C" clamp. I'm sure you know how these trophy figures are poured in a small shop.

I am interested in finding the names and addresses of firms who make small die casting machines —semi automatic. We want a machine to open and close the mold. We can still pour the lead by hand if necessary. Our castings never run over one pound.—J.W.S.

We suggest this reader contact the British Industries Corp., 80 Shore Rd., Port Washington, Long Island, N.Y. This company sells the DCMT die casting machine which can handle this type of job.—Ed.

MODEL NO. 301



COLOR FILL • CODE MARK • IMPRINT

your products, parts, caps, containers, etc. with the—

ACROPRINTER®

Tedious hand filling, messy spraying and sloppy applications of color . . . are eliminated when you use the ACROPRINTER®. We make a flexible die of ACROPRENE® to exactly match the cavity, depression and contour of your part or product, then set it in the ACROPRINTER® No. 301 or No. 401A . . . making your color filling operation a high production mechanical one that applies printing ink or enamel precisely and attractively. Die-Cast, stamped, embossed, molded, cast and engraved parts are accurately color filled with lettering and design.

®ACROPRINTER Model No. 401A

Model No. 301 is a hand operated machine adjustable for utmost perfection. Model No. 401A is the air-operated machine with that same precise touch and higher speed.

For FILLING or PRINTING, send a sketch, sample part or description with dimensions. Acromark Engineers will give you the full answer promptly, with illustrating data.

The ACROMARK Company

426 Morrell St., Elizabeth 4, N. J.

"The Original Marking Specialists"

Circle No. 110 on Reader Service Card

MR. FOUNDRYMAN:

Are you burning PROFITS in your furnaces?

Coreless electric induction furnaces cut operating costs and metal losses. Savings often pay for furnace in 1 year!

In today's highly competitive foundry business you can't afford out-dated methods and equipment. With rising labor and material costs, keeping pace with technological advances has become a do-or-die proposition. Progressive foundrymen the world over are learning that one of the quickest, surest ways of lowering production costs and improving quality is to convert to the coreless line frequency electric induction furnace pioneered by Brown Boveri. Many of them have paid for their original installation out of savings in the first year of operation! Proven designs available for every metal and in sizes to suit every application. Check the advantages listed below against your present equipment, then write us today for a full story on how Brown Boveri furnaces can put your foundry out ahead in the competitive race.

Brown Boveri line frequency installation for melting aluminum; each furnace rated 1.3 tons, 360 kw and 380 v.

Advantages

1. Cooler, cleaner foundry conditions . . . no need for a separate melting building or for summer shutdowns due to excessive heat . . . better labor-management relations.

2. Virtually no fumes . . . no costly exhaust systems.

3. No channels to be clogged . . . no frequency converter . . . no electrode consumption.

4. Rapid starting and stopping . . . no need to hold furnaces at temperature between shifts or over weekends.

5. Easier ramming of crucible lining . . . long lining and crucible life . . . simple crucible replacement.

6. Highest quality castings . . . less casting scrap . . . lowest gas content in metal.

7. Simple, foolproof design . . . no need for skilled operators . . . entire installation handled from central station with single push-button control . . . automatic power factor and automatic safety monitoring . . . one man can supervise several furnaces.

8. Lowest meltdown metal losses . . . rapid energy transfer results in shortest melting time . . . lowest consumption of flux.

9. Much greater use of scrap and borings for greater economy with minimum oxidation loss . . . cheaper materials produce product of high quality.

10. Hydraulic tilting mechanism . . . safety and precise control . . . hydraulic, heat-insulated furnace lid can be opened and closed in any furnace position.

11. Best alloying conditions. Perfect blending due to natural stirring action . . . most exact composition of alloys and full conservation of alloying elements . . . alloy additions made easily without segregation . . . quick changeover from one alloy to another.

12. Extremely accurate automatic temperature control and accurate reproduction of temperatures for uniform quality of successive charges . . . rapid, efficient superheating with maintenance of constant analysis . . . no possibility of local overheating.

13. Brown Boveri's unparalleled experience in furnace design, construction and operation . . . thousands of units of all types in successful operation . . . complete application department at your service.

BROWN BOVERI

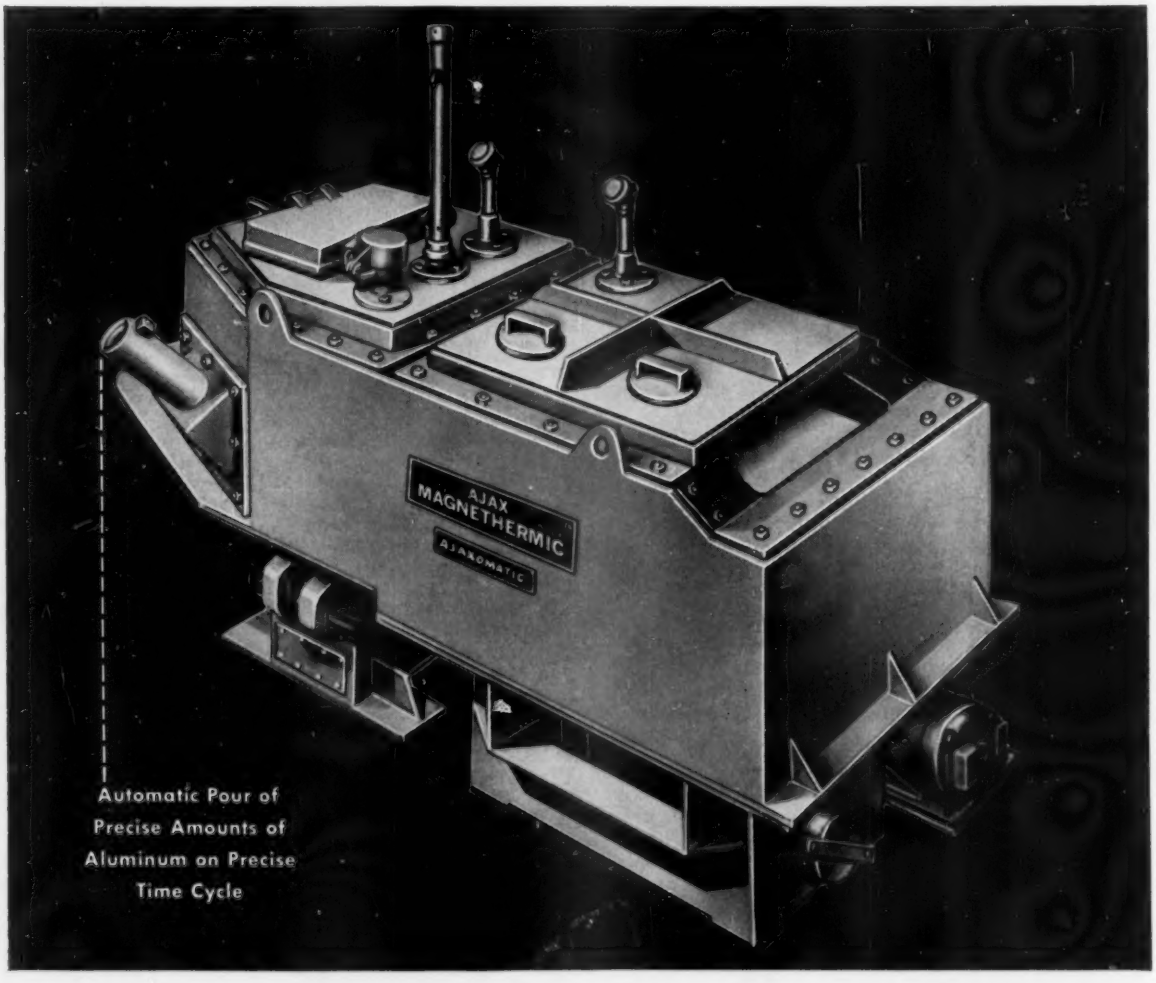
Brown Boveri Corp., Dept. F1, 19 Rector St., New York 6, N. Y. Agents in 27 U. S. cities. In Canada: Brown Boveri (Canada) Ltd., 1015 Beaver Hill Hall, Montreal 1, P.Q.

Brown Boveri offers a full range of line, medium and high frequency coreless and core-type induction furnaces; arc furnaces, resistance furnaces, radio frequency generators and complete accessories for a perfect mating of equipment to every operating condition and application. All backed by 70 years' experience in electrical and mechanical power equipment and one of the world's most extensive research and development programs in electrics and metallurgy assuring full unit responsibility and excellent coordination of every installation. Write for descriptive literature.

Circle No. 19 on Reader Service Card

AJAXOMATIC pours molten aluminum automatically to die casting machines.

Use: Whenever high speed, high casting weight or high quantity requirements make hand ladling too slow or too costly. *How:* Ajaxomatic (60-cycle core type induction furnace) automatically supplies molten aluminum to the machine in any size "shot" on precise time cycle. *Experience:* There are many Ajaxomatics in use. Some of the largest die castings produced are poured with Ajaxomatic. *Inquiry:* Write direct to us for additional information on Ajaxomatic Automatic Pouring Furnace by induction.



Automatic Pour of Precise Amounts of Aluminum on Precise Time Cycle

"induction heating is our only business"

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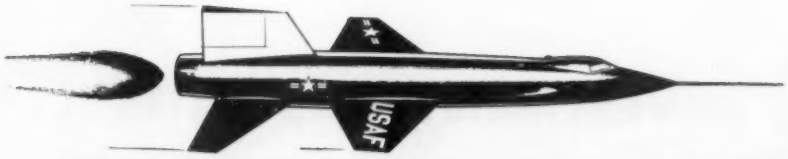
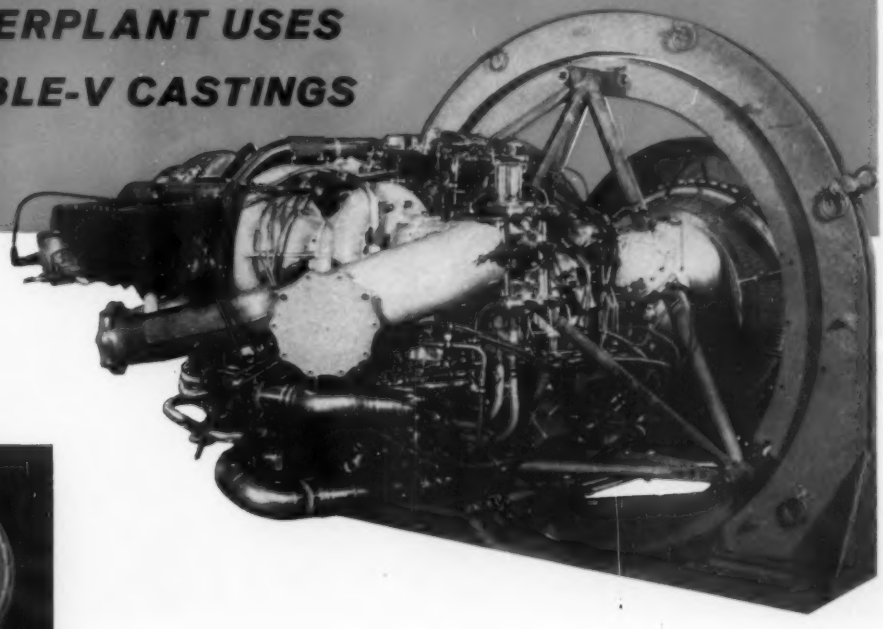
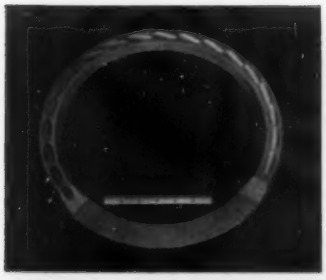


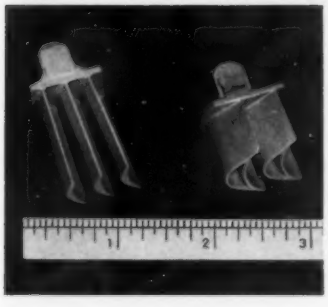
Misco RIDES WITH THE X-15!

POWERPLANT USES DOUBLE-V CASTINGS



One-piece Nozzle





Rotor Blade Segments

Two rotor blade segments, one with two blades, and one with three blades, produced by Misco's DOUBLE-V (Vacuum Melt and Vacuum Cast) System, of Udimet 500; and a one-piece cast nozzle of stainless steel, — are used in the turbo-pump of the X-15 powerplant. These castings were supplied to Reaction Motors Division of Thiokol Chemical Corporation.

Send us your inquiries, details of your requirements, or parts for quotation.

Misco Precision Casting Company

DIVISION OF HOWE SOUND COMPANY

Plants in
WHITEHALL, MICHIGAN
MUSKEGON, MICHIGAN

MISCO

Address inquiries to
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MONO-SHELL

Sales Offices in Principal Cities

PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

Circle No. 64 on Reader Service Card

V-R INVESTMENT CASTINGS . . .

Send for booklet No. VR-470.

DESIGN FLEXIBILITY . . .

provides cost savings by eliminating secondary operations. Irregular surface curvatures, thick and thin sections and shaped internal and external surfaces provide complete design freedom — no need to compromise with production limitations.

ALLOYS TO MEET YOUR NEEDS . . .

V-R investment castings are available in many alloys — such as a cobalt-chromium-tungsten cast alloy, 300 and 400 series stainless steels, ASI 8620 steel, low carbon steels and the beryllium coppers. V-R can develop and cast the proper material to meet the requirements of your application.

CLOSE TOLERANCES ON INTRICATE PARTS . . .

V-R specializes in casting *small* parts — often too small and intricate to be machined economically. Uniform, close tolerances are held throughout the entire production quantity.

METALLURGICAL KNOWLEDGE AND ENGINEERING SERVICE . . .

V-R metallurgists will be glad to study your application and recommend the proper alloy for your parts. Just send us the details of your problem including parts drawings and the requirements for resistance to heat, corrosion and wear.

V-R VASCOLOY-RAMET

CREATING THE METALS THAT SHAPE THE FUTURE

I-736R

854 MARKET ST. WAUKEGAN, ILLINOIS

Circle No. 91 on Reader Service Card

PMM

news of industry & associations

activities of people, companies & groups in the precision metal molding industries

DIE CASTERS MEET AT EXPOSITION, RAYNIAK GIVEN ACHIEVEMENT AWARD

TRIULZI BAUER KOEGLER

CLAYTON RAYNIAK

Notables brought together by the First National Die Casting Exposition and Congress in Detroit last November included G. Triulzi of A. Triulzi S.A.S., and A. F. Bauer and F. J. Koegler of Doehler-Jarvis.

Bauer was responsible for the production of the American Motors die cast engine block (two blocks on the right). Kaiser's die cast block, which was never used, is on the left. European blocks are die cast on machines Triulzi makes in Italy.

At the banquet held in conjunction with the exposition, the Society of Die Casting Engineers presented the first annual Achievement Award to Joseph G. Rayniak. The presentation was made by O. J. Clayton, 1960 president of the SDCE.

SCHMIDT PROCESS LICENSED HERE

The low-pressure aluminum casting process developed by Karl Schmidt G.m.b.H. of Frankfurt, Germany and used in this country to cast Corvair cylinder heads, is being licensed in the U.S. and Canada through Ladd & Little, Inc.

The new casting method has been used in Germany since 1957 and was adopted last year by General Motors for use at the Massena foundry (PMM Aug. 60).

In the Schmidt process, special type permanent molds are mounted on electric induction molten metal holding furnaces. Molten aluminum is forced upward by air pressure of about 10 psi into a mold cavity.

DOW CLOSES DIE CASTING PLANT

The Dow Chemical Co. has announced plans to close the die casting department of its plant in Bay City, Michigan. Operations of the facility will be phased out during the next few months. Present customers will be assisted in locating new sources for magnesium and aluminum die casting.

Spokesman listed two reasons for the action. The termination will withdraw Dow from competition with other die casters who are its customers for magnesium die casting ingot. The other reason is Dow's new customer service laboratory which has eliminated the need for facility.

POWDERED METAL DESIGN CONTEST

The second annual competition for the Non-Ferrous Metal Powder Part of The Year is now underway. A $500 award is made to both the product manufacturer and the fabricator submitting the winning brass, nickel silver, or pre-alloyed bronze powder part.

Originality of application, uniqueness of design, improved production economy, and the best utilization of metal powder properties and fabricating techniques are the contest criteria.

Complete contest information and entry blanks are available from the Awards Editor, Metal Powder Press, The New Jersey Zinc Company, 160 Front St., New York 38, New York.

EXTRUDERS ELECT LADERAR

Lewis Laderar of Wells Aluminum Co. was elected president of the Aluminum Extruders Council at their conference in Washington D.C. last month.

Roy C. Schoenhaar of Jasco Aluminum Products was elected vice president. Appointed to the board of directors was Harold L. Knapp of Air Master Corp. and Milton J. Smith of Trim Alloys.

In his address before the Council, Laderar called for increased cooperation between independent and prime producers to solve problems facing extruders.

more Industry News page 57

FOR A

QUALITY ALUMINUM PRODUCT

IN A QUALITY PACKAGE

SPECIFY WABASH!

"READY REFERENCE" ALUMINUM ALLOY SELECTOR

This Aluminum Alloy Selector was designed as a fast ready reference slide rule for the Die Casting, Permanent Mold and Sand Casting Industries. The Selector lists 59 Aluminum Alloys by their common designation with a cross index of SAE and ASTM equivalents.

In one glance, you have the chemical composition, heat treatment, minimum tensile strength, yield strength and elongation as well as casting type, thermal treatment, castability and machineability characteristics.

Kept in a pocket or nearby drawer, the Selector is an important MUST tool of the Aluminum Industry.

Write for your FREE selector.

WABASH SMELTING, INC.

Wabash, Indiana • Phone: 1400

Circle No. 93 on Reader Service Card

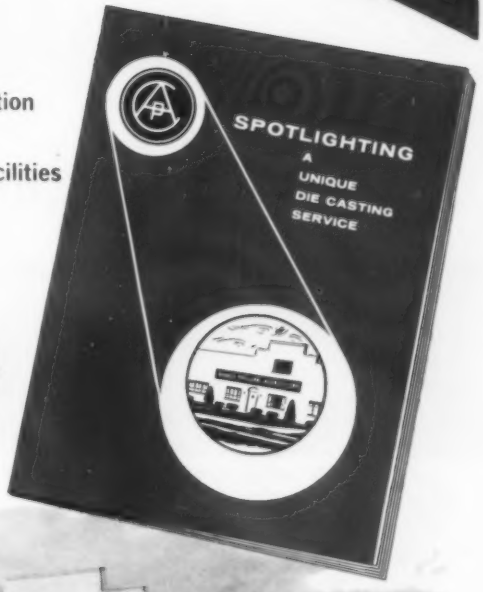
SPOTLIGHTING

A UNIQUE DIE CASTING SERVICE!

Of the many reputable sources for quality zinc and aluminum die castings, the new Advance Pressure Castings Corp. plant at Denville, New Jersey offers a number of sound reasons why APC may be your logical choice when buying such components.

These reasons, which have to do with production experience, the latest in die casting and auxiliary equipment, complete die making facilities and an enviable reputation for service, are fully covered in a new book which you are urged to send for today.

This book may well lead you to economies and advantages in the use of die castings which can greatly increase your competitive position in your field of product manufacture.



ADVANCE PRESSURE CASTINGS CORP.

276 STATE HIGHWAY 53, DENVILLE, NEW JERSEY · PHONES: OAkwood 7-6600 (New Jersey) EVergreen 9-4890 (New York City)

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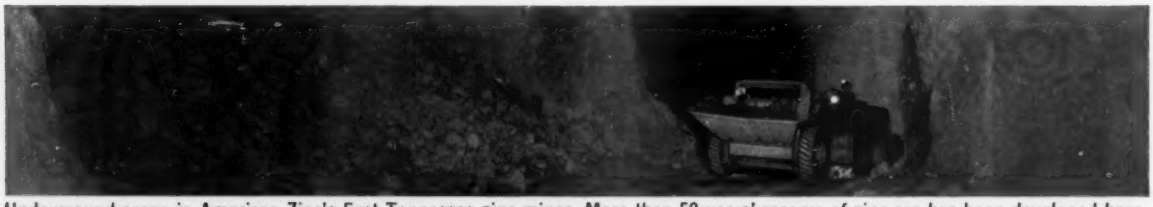
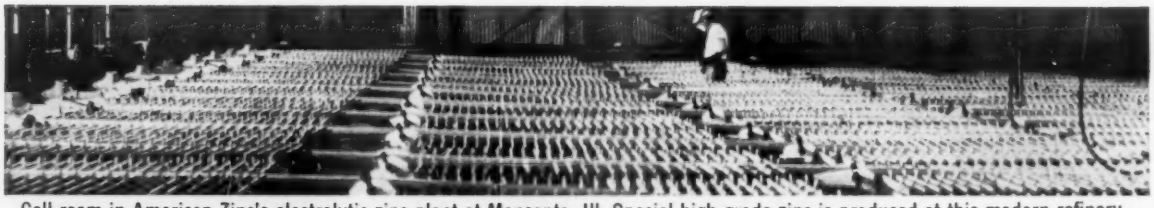
Circle No. 2 on Reader Service Card

INTEGRATED PRODUCTION—from Ore to Ingot



Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of



Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

AZCO Zinc Die Cast Alloys

Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company

1515 Paul Brown Building, St. Louis 1, Missouri

Distributors for:

AMERICAN ZINC, LEAD AND SMELTING COMPANY

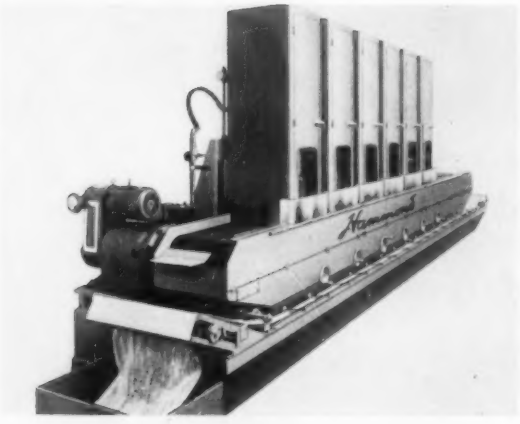
Detroit • Columbus, O. • Chicago • St. Louis • New York

Circle No. 10 on Reader Service Card

PMM

new products & developments

qualified readers can get complete details on these products. Use the reader service cards. Information presented here is the manufacturers' own assessment of their products.



FLAT FINISHER HAS AUTOMATIC BELT TRACKING

HAMMOND MACHINERY BUILDERS, INC.—An automatic, air actuated, belt tracking and oscillation feature is available on all models of Hammond flat finishers.

This device assures longer belt life, better finish, and substantial savings in labor. After tracking has been set, no further attention from the operator is needed until a new belt is installed.

Other features include automatic air tensioning, variable speed conveyor, and work pressure ammeters on each polishing head.

These high production machines are used for wet abrasive belt grinding, polishing, and deburring in one operation for all flat work.

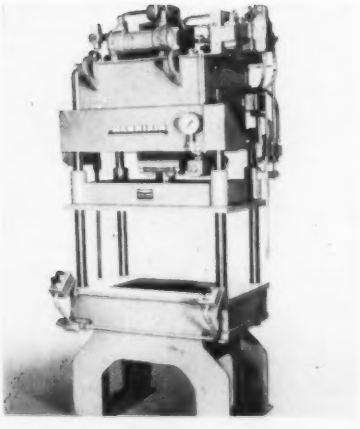
Circle No. 235 on Reader Service Card

VIBRATORY FINISHING MACHINE

STEVENSON COMPANY—The Vibrodyne Model V-013 vibratory finishing machine is designed especially for laboratory use and quantity production finishing of small precision parts. The unit is particularly adapted for deburring, radii-forming, descaling, cleaning, and polishing of small parts, powdered metal gears, steel bushings, and many other parts.

Efficient operation and simplicity of design permits considerable savings in operating and maintenance costs. Vibration amplitude is varied by a variable transformer while the frequency remains constant.

Circle No. 236 on Reader Service Card



HYDRAULIC TRIMMING PRESS

HANNIFIN COMPANY—This newly designed, 30-ton, four column, hydraulic trimming press for large dies features a high speed advance to 1300 i.p.m.

Although capable of high speed operation, ram speed may be reduced to 240 i.p.m. at casting contact. Castings are then trimmed with a "squeeze" rather than a blow. This soft shearing action gives a cleaner, more accurate casting trim. This reduces the danger of damage to dies and minimizes rejected castings.

Compact design allows the press to be placed in areas near casting machines. This eliminates transportation and stacking damage to still-warm castings—common when the press is far removed from the casting machine. Other specifications include a 20″ stroke, 30″ gap. Ram speeds are 1300 i.p.m. rapid advance, 240 i.p.m. feed and 790 i.p.m. return.

Circle No. 237 on Reader Service Card

more New Products on page 57

Why you can be sure...

Celanese Cellulubes are the best functional fluids you can use

There are four practical reasons behind our claim that *you just can't buy better fire-resistant hydraulic fluids or air compressor lubricants than Celanese Cellulubes.*

1

BASIC PRODUCER—Celanese was the *first* to produce phosphate esters . . . and is the *only* producer currently marketing a series of industrial phosphate ester lubricants. Experience has demonstrated that we now have one of the best equipped plants in the country.

2

APPLICATION ENGINEERING—Our files contain facts about hundreds of successful Cellulube applications in many industries. Celanese engineers have the experience and interest to help you make the most of these functional fluids.

3

QUALITY CONTROL—Celanese zealously guards the quality of Cellulubes by a system of constant checks and controls. Physical and chemical properties are strictly maintained within exacting limits to assure you of optimum performance for fire-resistance and lubrication. What's more, Cellulubes have passed the most rigorous tests that the military and some of America's largest companies could devise.

4

TECHNICAL ASSISTANCE—Our technical staff provides assistance to see that the changeover from conventional fluids to Cellulubes is made as quickly and easily as possible. In many cases, our salesmen provide all necessary conversion know-how.

Fire-resistant Cellulubes are available in *six* controlled viscosities. Not only are they outstanding for the prevention of fire and explosion, but they give overall wear protection comparable to premium petroleum oils. Get the complete facts by using the coupon below. Celanese® Cellulube®

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180 Madison Avenue, New York 16, N. Y.

Please rush me a copy of your manual on Cellulubes as
☐ hydraulic fluids ☐ synthetic lubricants

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Celanese CHEMICALS

FM Factory Mutual-Approved (Cellulubes 150 and 220)

Bureau of Mines-Approved #30-2

Celanese Chemical Company is a Division of Celanese Corporation of America.
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Canadian Chemical Company Limited, Montreal, Toronto, Vancouver.
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Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., New York 16.

Circle No. 119 on Reader Service Card

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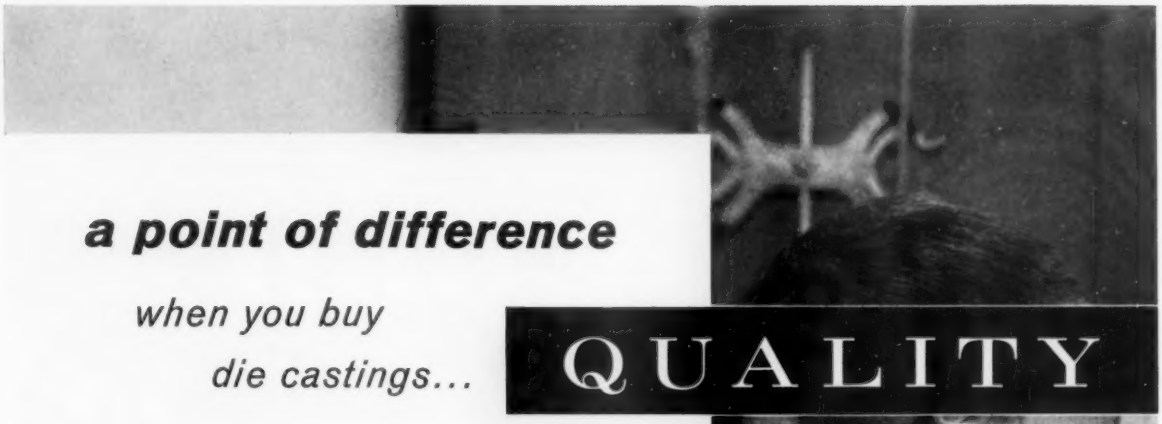

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ALUMINUM AND ZINC DIE CASTINGS
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DIE CASTING SHOW LITERATURE

For those who missed the Die Casting Exhibition in Detroit, here is a list of literature offered by the exhibitors.

Qualified readers may obtain copies by using the reader service card.

270. Aluminum Alloys—Wabash Smelting Inc.—Slide-rule type alloy selector lists compositions, designations, properties, and heat treating information for aluminum alloys.

272. Fire-Resistant Fluids—Celanese Corp. of America—34-page technical booklet gives application data and complete information on fire-resistant hydraulic fluids.

273. Die Casting Accessories—Advance Products Corp.—Data sheets describe a line of shot sleeves, bushings, plunger tips, and water junctions.

274. Die Casting Alloys—Samuel Greenfield Co., Inc.—Technical data on the chemical compositions and typical properties of aluminum and zinc alloys.

275. Die Casting Machines—Hydraulic Press Div., Koehring Co.—13-page bulletin gives complete specifications on the Cast-Master line of die casting machines.

276. Vibratory Finishing—Productive Equipment Corp.—4-page brochure on the Selectro vibratory finisher for deburring, burnishing, and coloring.

277. Marking Tools—Union Steel Stamp & Die Engravers Inc.—24-page catalog describes a line of marking tools, embossing dies, and production engraving equipment.

278. Die Steels—Columbia Tool Steel Co.—Technical data sheets list heat treating data, chemical compositions, and applications for a line of hot work tool steels.

279. Alloys—Apex Smelting Co.—8-page technical booklet lists a line of aluminum, magnesium, and zinc die casting alloys, includes data on composition and properties.

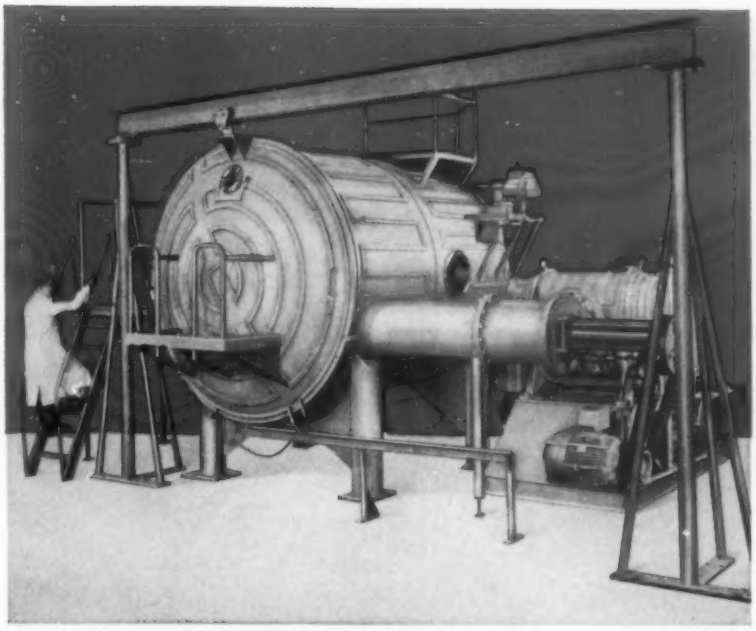
280. Die Casting Dies—Midland Die & Engraving Co.—Information on their facilities and capabilities for making dies and molds.

281. Die Casting Machines—Cleveland Automatic Machine Co.—12-page booklet lists specifications on a complete line of die casting machines.

282. Alloys—George Sall Metals Co., Inc.—Bulletin gives information on a trial order plan for casting alloys.

283. Aluminum Alloys—Aluminum & Magnesium Inc.—Reprint of a PMM article, "Metallurgy of Die Cast Aluminum Alloys."

continued on page 28



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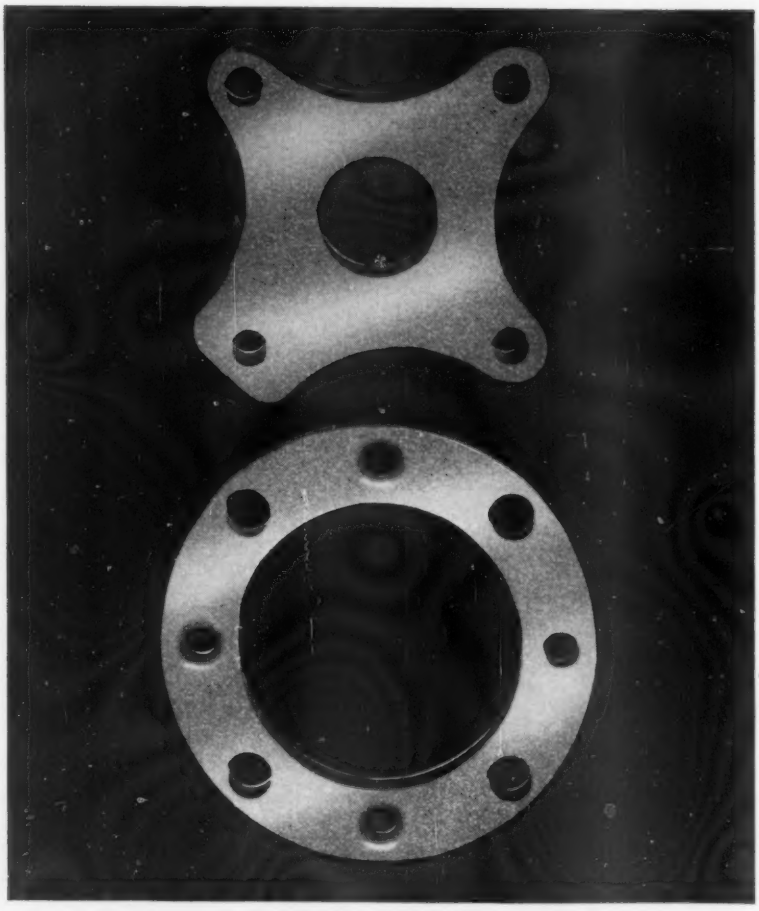

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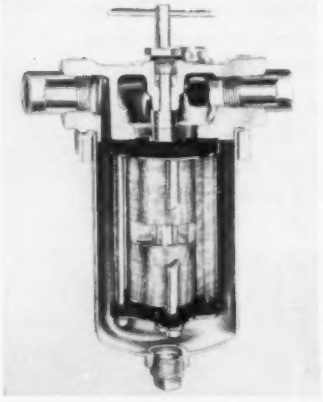

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SHOW LITERATURE
continued

284. Patterns—Erler Pattern & Model Corp.—12-page facilities brochure on making patterns and models.

285. Die Temperature Control—Industrial Mfg. Corp.—Brochure describes a unit which maintains a pre-selected die temperature.

287. Goosenecks—Dodge Steel Co.—Data sheet describes custom made. special alloy steel goosenecks.

288. Melting Furnaces—Lindberg Engineering Co.—Technical bulletin describes two-chamber induction melting furnaces.

289. Tool & Die—Permanent Mold Die Co.—12-page facilities brochure shows how they make permanent mold and die casting dies.

290. Vibratory Finishing Machines—Pangborn Corp.—Bulletin describes a line of air-cushioned vibratory finishing machines.

291. Die Casting Dies—R. H. Freitag Mfg. Corp.—Bulletin shows their capabilities for making die casting dies.

292. Die Steel—Latrobe Steel Co.—Technical bulletin on Viscount 44 hot work die steel for extrusion and die casting dies.

293. Anodizable Die Castings—U.S. Reduction Co.—Data sheet lists the properties and anodizing procedures for a suitable aluminum die casting alloy.

294. Machine Tools—Greenlee Bros. & Co.—18-page booklet describes a line of machine tools.

295. Die Casting Machines—Lake Erie Machinery Corp.—Brochure gives complete information on die casting machines.

296. Castings—Bendix Foundries—Facilities brochure tells how all casting processes are at your disposal at Bendix.

297. Dies & Molds—Atols Tool & Mold Corp.—Data sheet lists their tool and die making equipment.

299. Die Casting Machines—Lester-Phoenix, Inc.—Bulletin describes a 125-ton automatic zinc die casting machine.

300. Tool & Die—Northern Tool & Die Co.—Brochure lists their equipment for making dies, tools, jigs, and special machinery.

302. Trim Presses—Clearing Div.—10-page technical bulletin lists complete specifications on the Torc-Pac O.B.I. presses.

303. Sonic Die Casting—Southern Die Casting & Engineering—Brochure describes the Vibrocast process of passing sonic waves through the die to improve die castings.

304. Die Casting Dies—Shaw Process Development Corp.—Bulletin describes the Shaw Process of investment casting die casting dies.

305. Die Casting Accessories—Martin Grinding & Machine Works Inc.—Complete specifications on a line of stock cold chamber sleeves, plunger stems, and plunger tips.

continued on page 30

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DIE CASTING MACHINES

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Model OL/V 275 tons

DIE CASTING MACHINES
WITH VERTICAL COLD CHAMBER
OL/V. RANGE
Locking pressure: 110 - 165 - 275 - 440 tons.

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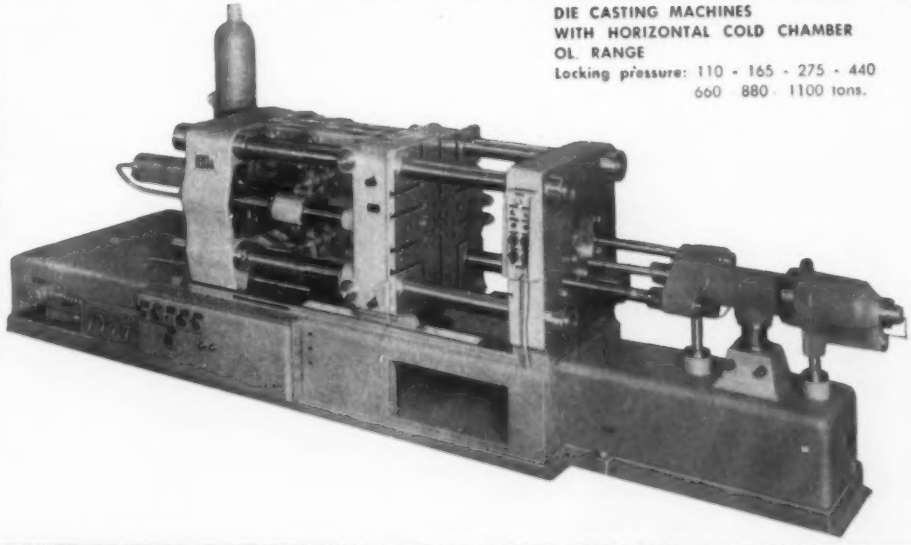
OL/V. RANGE

Locking force	Max. injection force	Dimensions of platens	Movable die platen stroke	Max. weight of castings (AL.)
110	17,6	20 3/16"x21 5/8"	9"	1,71
165	23	25 1/2" x25 1/2"	11 13/16"	2,86
275	38,5	31 7/8" x32 9/32"	14 3/4"	4,84
440	60,5	37 5/16"x37 5/16"	16 3/4"	16,28
tons.	tons.	inc.	inc.	lbs

OL. RANGE

Locking force	Max. injection force	Dimensions of platens	Movable die platen stroke	Max. weight of castings (AL.)
110	8,8	20 3/16"x21 5/8"	9"	2,64
165	16,5	25 1/2" x25 1/2"	11 13/16"	4,4
275	31	31 7/8" x32 9/32"	14 3/4"	6,6
440	44	37 5/16"x37 5/16"	16 3/4"	12,76
560	60,5	45" x45"	18 11/16"	17,6
880	82,5	51" x51"	20 5/8"	30,8
1100	88	57 1/2" x57 1/2"	23 5/8"	39,6
tons.	tons.	inc.	inc.	lbs

Model OL 440 tons



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WITH HORIZONTAL COLD CHAMBER
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Locking pressure: 110 - 165 - 275 - 440 660 - 880 - 1100 tons.

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SHOW LITERATURE

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306. Plating—Frederic B. Stevens, Inc.—Brochure describes the "Little Steve" automatic plating and processing machine.

307. Plunger Rings—Precision Piston Rings, Inc.—Bulletin lists complete specifications on unbreakable stainless steel plunger rings.

308. Unit Dies—Detroit Mold Engineering Co.—6-page brochure gives complete engineering data on standard unit dies for zinc and aluminum die castings.

310. Die Lubricants—G. W. Smith & Sons Inc.—List of data sheets available on die lubricants fitting special requirements.

311. Melting Furnaces—J. A. Kozma Co.—Data sheet lists aluminum melting and holding furnaces which permit sounder castings.

312. Die Casting Machines—Reed-Prentice Div.—Technical bulletin lists engineering specifications and features of a 400-ton, cold chamber die casting machine.

313. Die Castings—Wolverine Die Cast Corp.—Brochure describes their facilities for die casting.

314. Crucibles—Vesuvius Crucible Co.—Complete specifications on a line of crucibles for melting and holding aluminum.

315. Drill Units—Drillmation Co.—Brochure describes a line of hydraulic, quill-type drill units.

316. Zinc Alloys—National Lead Co.—Brochure lists the chemical composition of Bunker Hill Zinc alloys.

317. Straightening Machine—Service Machine & Supply Co.—Booklet describes a machine which corrects distortion in die castings.

318. Die Casting Dies—Alliance Mold Co. Inc.—Brochure describes facilities for making die casting dies.

319. Die Lubricants—American Charcoal Co.—External house organ publishes news and views on the die casting industry.

320. Die Castings—Jervis Corp.—6-page booklet describes their facilities for product designing, die casting, and plating.

321. Die Steels—Crucible Steel Co.—16-page technical booklet lists data on the properties and heat treating of hot work die steels.

323. Die Casting Dies—R. O. Schulz Co.—Brochure describes their facilities for making die casting dies.

325. Plunger Rings—Auto-Diesel Piston Ring Co.—Brochure lists six advantages of steel plunger rings that prevent scoring.

326. Fire-Resistant Fluids—Monsanto Chemical Co.—Literature tells how to use its fire-resistant hydraulic fluids.

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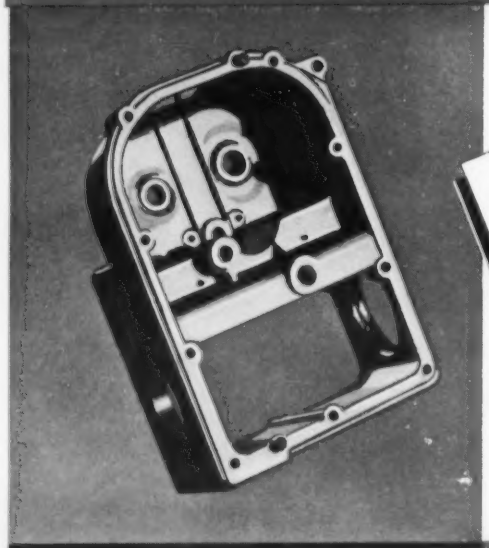

Dimensional stability and close tolerance make zinc superior for die casting

Dimensional stability is vital in many die cast parts, particularly for easy and consistent mating of complex shapes. ZINC offers the highest dimensional stability of all common die cast metals. ZINC can be cast to remarkably close tolerances, often eliminating entirely the need for machining.

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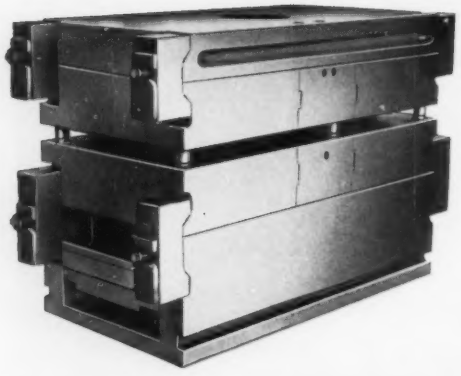

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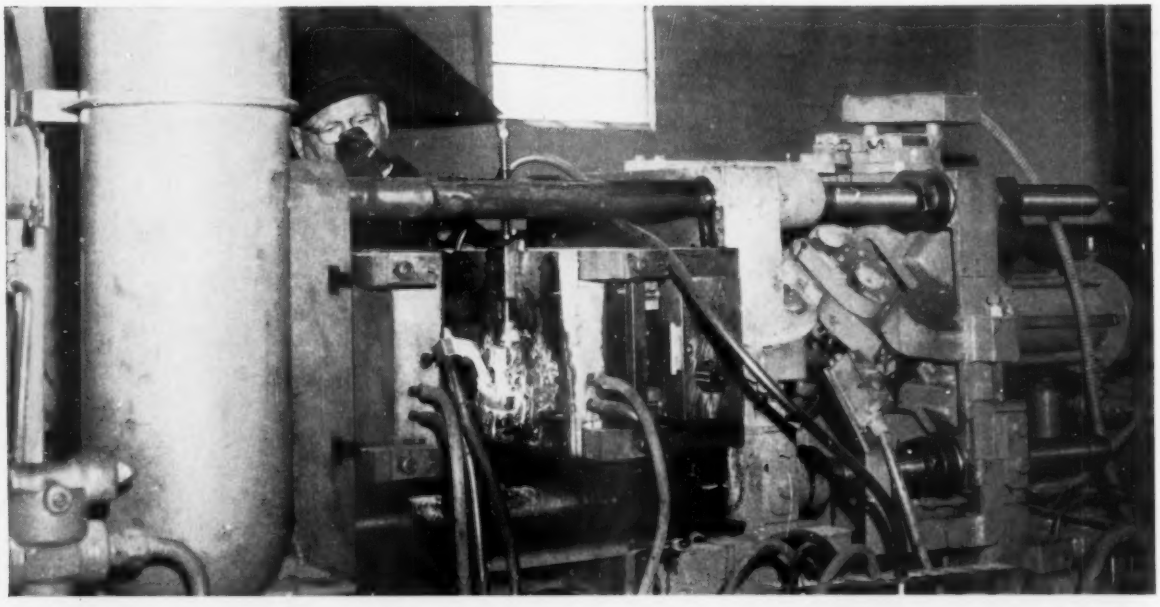

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Standard Replacement Units are quickly positioned in the Unit Die Holder by a precision T-slot in the mating edge of the plates; there is no interference with the cavity layout.

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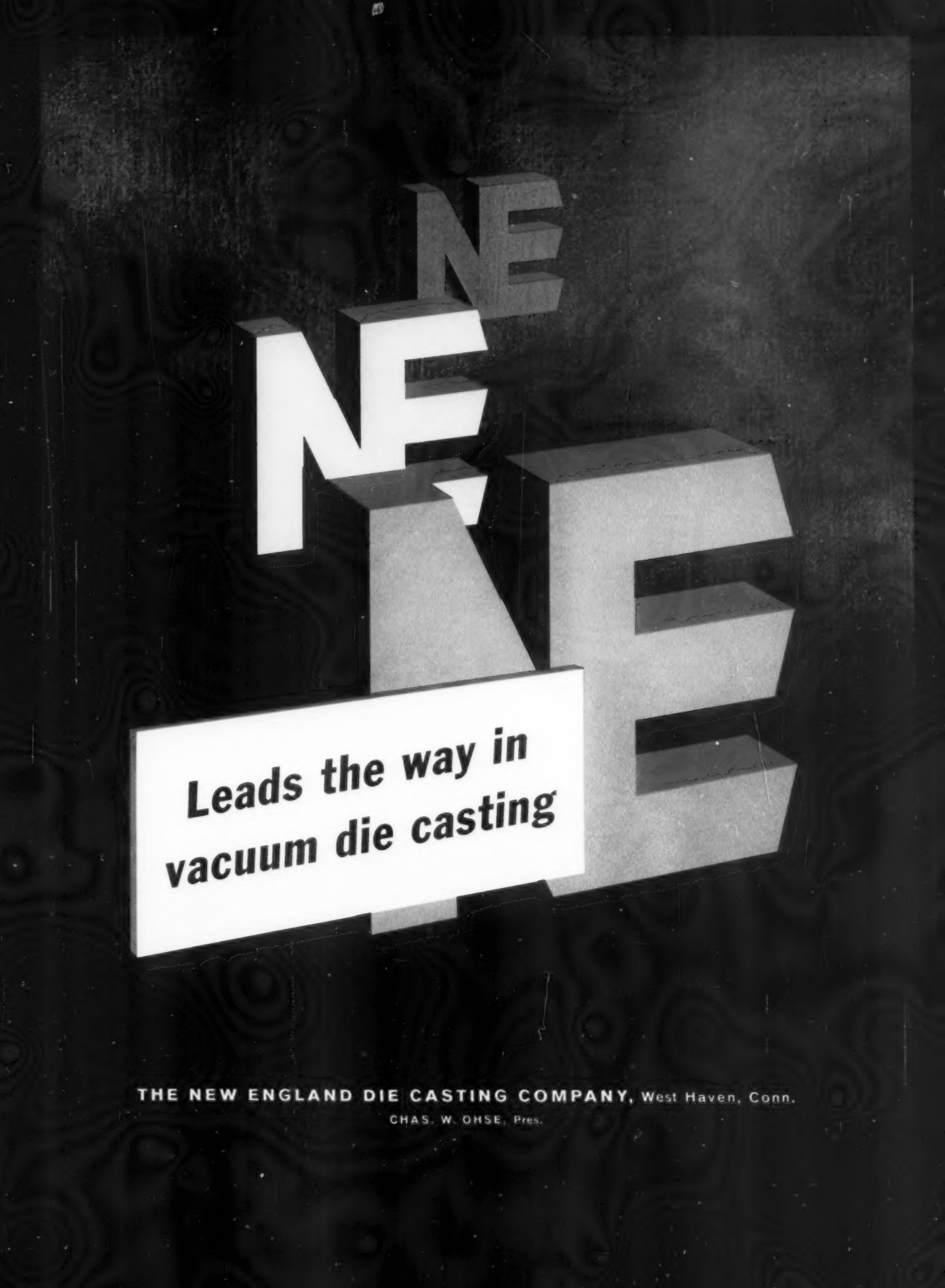

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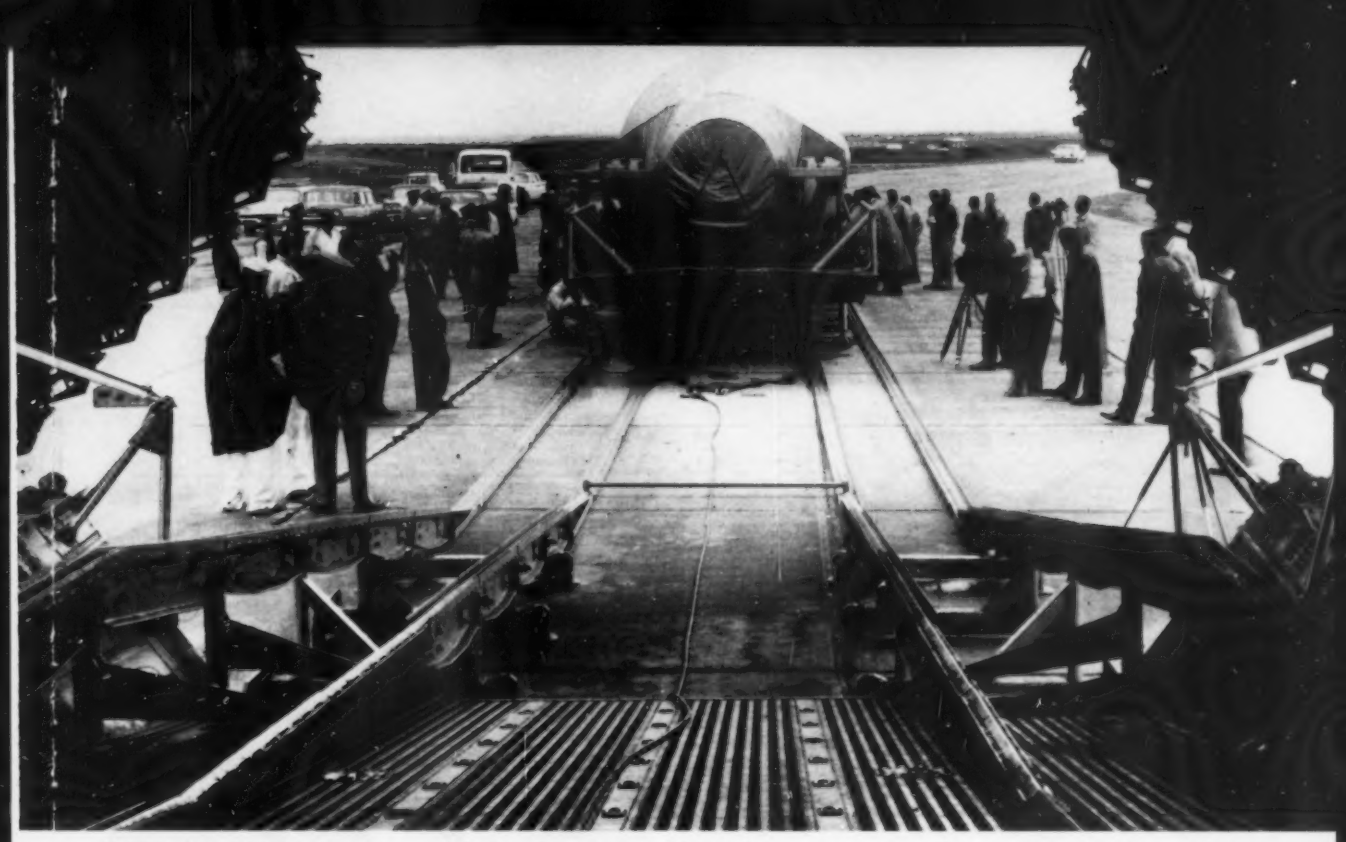


INTEGRAL REAR LOADING ramp of the Douglas C-133B is fabricated from magnesium pellet extrusions. An Atlas missile is shown about to be loaded into the aircraft.

EXTRUDED MAGNESIUM PELLETS

. . . surpass the highest magnesium alloy strength specifications

By R. S. BUSK, *Head, Metallurgical Laboratory, The Dow Metal Products Company*

THE EXTRUSION OF PELLETS of ZK60 into structural shapes has been a commercial process at The Dow Metal Products Company for two years.

The extruded product, known as (P)ZK60B, is made to the highest strength specifications of any magnesium-base alloy regardless of process or form.

There are two critical steps in the process: (1) atomizing a stream of liquid alloy into spherical pellets of the desired size; and, (2) extrusion of the pellets into the desired shape.

The pellets used must be spherical to minimize surface area; they must contain a minimum of fine dust; they must have an average particle size between 100 and 400 microns, and this must be controllable within close limits; they must be quenched rapidly from the liquid state to a temperature low enough to prevent any solid diffusion; and they must be produced in a way which will result in as clean a surface as possible. All of these conditions are met with the process which has been developed and is now in use to produce ZK60B pellets.

ATOMIZING

Briefly, the atomizing process consists of delivering a vertical stream of molten alloy to the center of a rapidly rotating disc. The disc spreads the metal into a thin horizontal sheet. The sheet breaks into droplets which freeze into spherical particles. The process is conducted in a natural-gas atmosphere. The preparation of the molten metal and its delivery to the atomizing nozzle is standard and will not be described. The heart of the process is the turbine[1] which drives the disc the stream of molten metal falls on.

The construction of the turbine is shown in Fig. 1. The rotating disc is supported on a cushion of the same gas used as the driving medium. An electromagnet acts to stabilize the disc and prevent it from being thrown out of the stator portion of the turbine. The speed of the wheel is measured by the frequency imposed on a D. C. current by a rotating slot in the base of the disc. This turbine is capable of delivering large amounts of power and is relatively unaffected by eccentric loading. Speed of rotation is limited

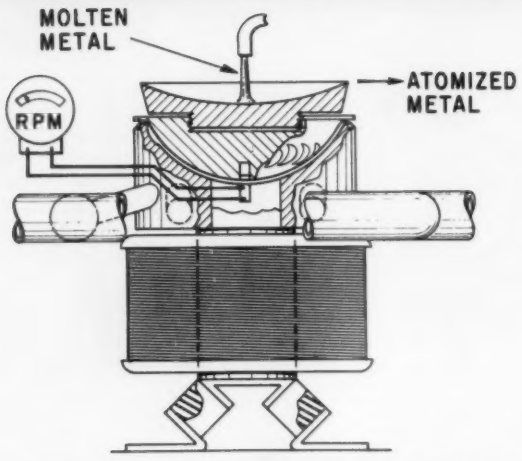


FIGURE 1 ATOMIZING TURBINE has a rotating disc supported by the same gas used to drive it.

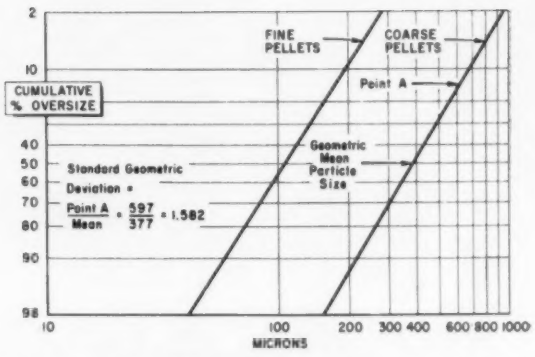


FIGURE 2 PARTICLE SIZE distribution obtained by wheel atomizing is rather narrow.

only by the strength of the material from which the disc is made. The exact shape of the disc is not critical.

Control of the droplet size was studied by Walton and Prewett[2]. Through study of the action of a spinning disc on mercury, water, dibutyl phthalate, methyl salicylate, glycerine, dekalin, tricresyl phosphate and ethylene dibromide, they concluded that particle size is related to material and process variables according to the equation:

$$d = \frac{K}{W}\left(\frac{T}{DP}\right)^{\frac{1}{2}}$$

d = particle diameter (cm)
W = angular velocity of wheel (radians/sec)
T = surface tension of liquid (dynes/cm)
D = wheel diameter (cm)
P = density of liquid (gm/cc)
K = constant (equal to 4.5 for all materials)

The equation assumes that the liquid receives a uniform angular acceleration from the wheel and that the liquid wets the wheel to get good transfer of motion. This is an important requirement for selection of a disc material.

When the data from a large number of runs on magnesium are substituted in the equation (using 542 dynes/cm for surface tension and 1.6 gms/cc for density), the value of K is 4.1. This agrees well enough with the K value given by Walton and Prewett so that their equation can be used for calculation of the particle size.

Two practical considerations determine the limiting particle sizes that are obtainable today. The bursting strength of steel, combined with the wetting requirement, sets a lower limit of about 70 microns for the smallest average particle diameter. The upper limit—about 450 microns—is governed by the diameter (20 ft). of the particular tank within which we are atomizing. Particles larger than this strike the tank walls before freezing and combine into large stalactites.

Particle diameter is inversely proportional to wheel speed. Control of the average particle size obtained, within the limits of 70-450 microns, is, therefore, easy. Particle size distribution for any given average particle diameter is rather narrow as is shown in Fig. 2. The particle distribution follows a normal geometric distribution law and any given distribution can be fully defined by two parameters—a geometric mean, and a standard geometric deviation.

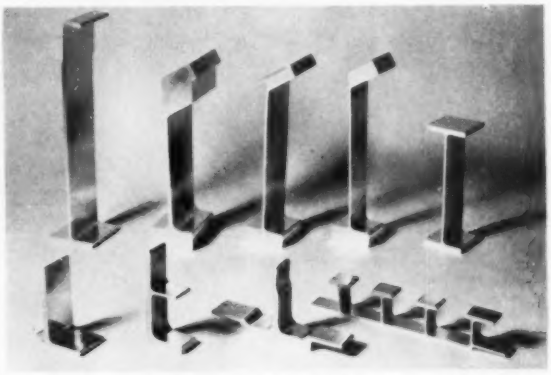


FIGURE 3 ALMOST ANY SHAPE which can be extruded can be made by the extrusion of pellets.

EXTRUSION

The extrusion of magnesium powder has been described by a number of authors[3-4]. This report will be confined to the extrusion of atomized magnesium "pellets" as practiced by the Dow Metal Products Company. The word "pellet" is preferred to "powder" because it is more descriptive of the 350 micron diameter particles. In the extrusion step, loose pellets are loaded into the extrusion container, the ram is advanced, and extrusion through the die accomplished. In this relatively simple operation, the coarse, wheel-atomized pellets have three distinct advantages: (1) there is an almost complete absence of dust fine enough to become airborne; (2) the surface area is small enough to keep the oxide content low and (3) there is no bridging to entrap air between the particles before compacting. It is critically important to eliminate any entrapped gas or other material that could result in blistering of the hot extrusion. Clean powder and good processing do this. Handling of the extrusion is identical to conventional extrusions produced from ingot or billet.

Almost any shape which can be made by extrusion can be made by extrusion of pellets. Fig. 3 shows a few which have been produced. The density is equal to that of ingot produced material, and the pellet extrusions can be welded, forged and rolled as easily as ingot extrusions.

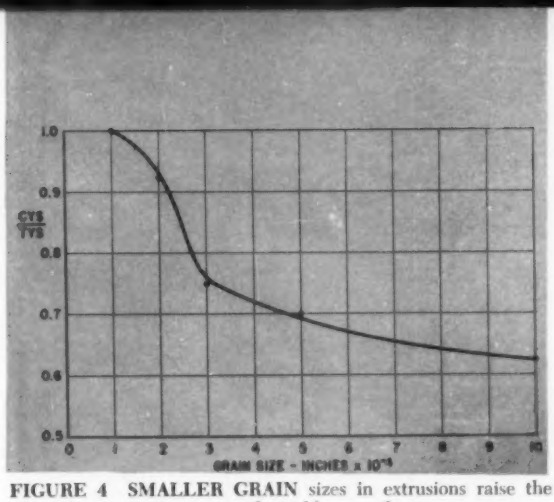


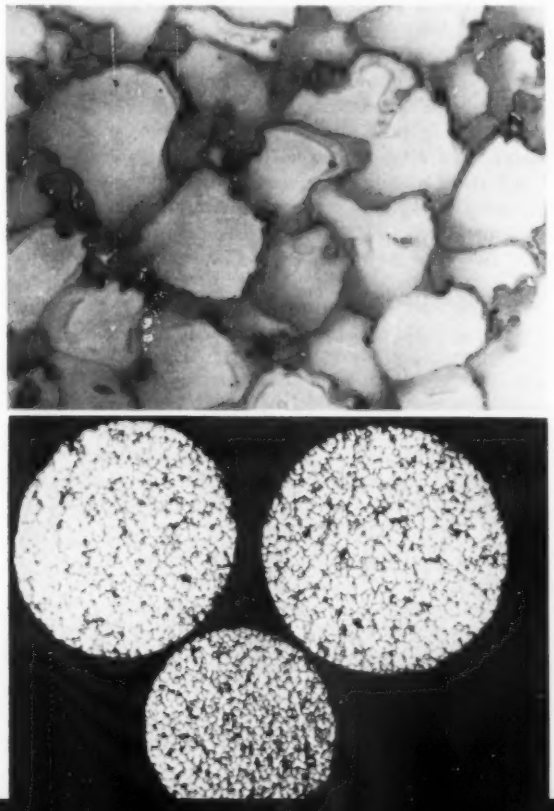
FIGURE 4 SMALLER GRAIN sizes in extrusions raise the ratio of compressive to tensile yield strength.

METALLURGY

While the use of pellets for extrusions has many advantages, the one that has been exploited is the characteristic fine grain size. This is especially important for magnesium-base alloys because of the anisotropy of yield strength common to wrought products. The preferred orientation of an extrusion is such that twinning is easily accomplished by compression in the longitudinal direction resulting in a lower yield strength in compression than tension. As the grain size decreases, twinning becomes progressively more difficult and the CYS approaches the TYS in value. This effect is shown in Fig. 4.

Doan and Ansel[4] showed that the grain size in magnesium alloy extrusion can be controlled by "alloy gradients". That is, the grain size of the extrusion will be related quantitatively and directly to the scale of coring in the casting from which the extrusion is produced. Therefore, a casting process should produce coring on as fine a scale as possible if a minimum grain size in the extrusion is desired. This is one of the advantages of the D. C. casting process over the permanent-mold method of producing extrusion ingot. The atomizing of a magnesium alloy results in a cast structure within each pellet that is close to the ultimate in fineness of coring. Therefore, the grain size of extrusion made from pellets is exceptionally small.

FIGURE 5 MICROSTRUCTURE of ZK60 when cast by the D.C. process (top) compared to the pellet process (bottom).



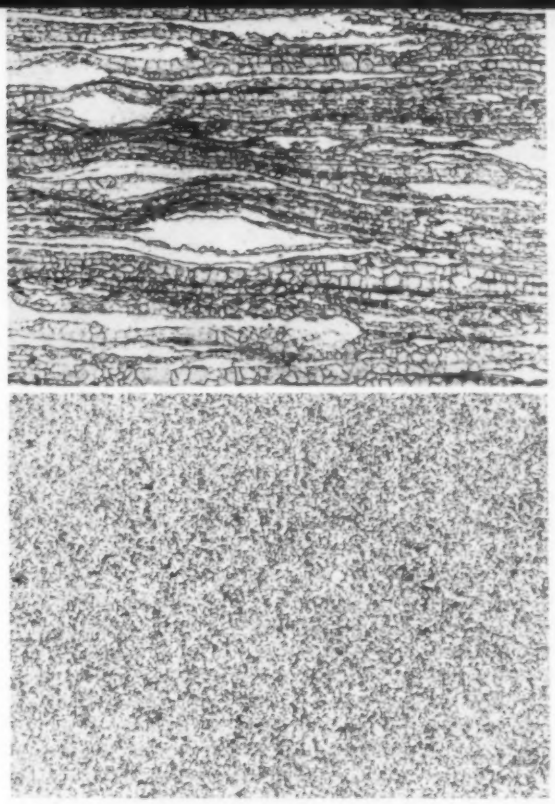


FIGURE 6 EXTRUSION microstructure when made from D.C. ingot (top) compared to pellets (bottom).

These effects are illustrated in Fig. 5 and 6. Fig. 5 is a comparison between the cast structure of a D. C.-cast ingot of ZK60A and the cast structure of a pellet of ZK60B. The much finer grain size and, more importantly, the finer scale of coring in the pellet is quite apparent. The structures of the extrusions from these two products are shown in Fig. 6. There is a clear advantage to the extrusion made from pellets. Referring to Fig. 4, one would predict a CYS/TYS of 0.8 for the ingot extrusion and 1.0 for the pellet extrusion.

While the control of grain size through control of coring has led to the development of an alloy with the highest specified properties of any magnesium-base alloy, there are a number of other advantages to the use of pellets which we are now beginning to use for the development of still more useful alloys.

Although the control of grain size through control of the degree of coring is effective, it depends upon maintaining the alloy gradients throughout the extrusion process. This means that the temperatures to which the pellets and the extrusion are subjected must be kept low enough, or the time short enough, to prevent diffusion. In practice, the properties from the

butt end of a large extrusion tend to be low as compared to those of the balance of the extrusion. for example; the properties of a large I-beam were found to be:

		1000 psi		
(P)ZK60B	%E	TYS	CYS	TS
Nose	17	41	44	50
Middle	18	41	44	50
Butt	18	39	39	48

This effect is due to the combination of extra time at temperature and the more extensive working the butt end of the extrusion receives. It is, in fact, sufficient for enough diffusion to occur to result in a lowering of both the TYS and CYS. Additional, and in some respects more positive, control over grain size may be had by introducing small particles of a relatively insoluble phase[6]. The use of pellets is advantageous for this purpose since the rapid rate of cooling from the molten state results in any particles of second-phase material being very small and therefore well dispersed. A suitable element for this purpose is any of the rare earth metals. Figure 7 illustrates the microstructure that is obtained when pellets contain mischmetal. The fine dispersion of Mg_9Ce which is obtained results in inhibition of grain growth in extrusions made from the pellets. Since rare earth elements are not very soluble in magnesium, the inhibition is relatively insensitive to temperature and the extrusion can be heated to quite high temperatures without a marked change in grain size.

Since the extrusion process enables the production of high-density, sound metal from pellets, the possi-

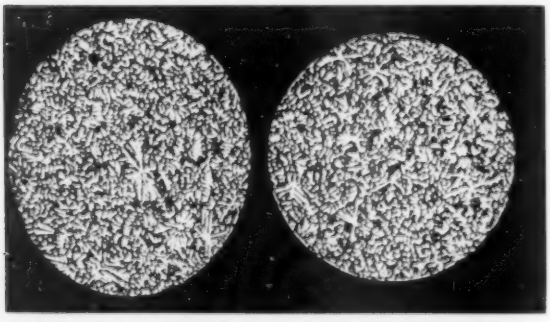


FIGURE 7 PELLETS containing mischmetal (250 x).

bilities for producing alloys are increased by one dimension. That is, the structure of an alloy is no longer limited to what happens as metal of given composition freezes; the structure can also be influenced by diffusion in the solid state. One can work horizontally as well as vertically through a phase diagram. Completely homogeneous alloys can be produced by starting with elemental powders and diffusion to equilibrium. Interesting structures can be obtained by interrupting the approach to equilibrium at various stages. Among the more interesting structures, however, are those produced by diffusing mutually incompatible elements into a common matrix. Of the various possibilities, the most interesting combination is that of aluminum and zirconium in a magnesium alloy matrix[7]. If elemental aluminum is diffused into magnesium containing zirconium in solid solution, a precipitate of $AlZr_4$ is produced throughout the entire alloy. Since this compound is insoluble in magnesium at any temperature, the reaction is irreversible and the size and distributon of the precipitated particles remain constant even though the alloy is heated to very high temperatures. Fig. 8 shows the structure of a co-extrusion of a Mg + 1% Zn + 0.25% Zr alloy and aluminum compared to the same extrusion after a heat treatment of 16 hours at 800F. Note that there is practically no effect of the heat treatment on the grain size of the extrusion. This heat treatment would cause excessive grain growth in the Mg-Zn-Zr alloy were the aluminum not present. Properties of an extrusion made in this way are high both because of a fine grain size and because of the presence of a fine precipitate.

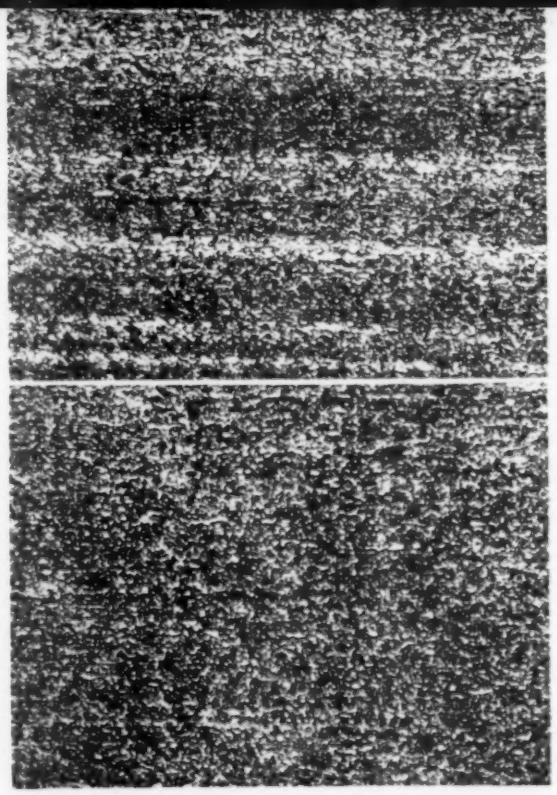


FIGURE 8 GRAIN STRUCTURE of a co-extrusion after extruding (top) and after heat treatment (bottom).

A further metallurgical possibility inherent to pellet extrusion is the co-extrusion of non-metallic material with an alloy. Special effects can be obtained in this way, two of which will be in a later article.

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HEAT TREATMENT OF CAST STAINLESS STEELS PART II

By W. P. JAMES, *WaiMet Alloys Co.*

This paper is part of the Investment Casting Institute Intra-Industry Research Program.—Editor.

PART I of this report pointed out that the investment casting process is well adapted to utilize the attractive properties of hardenable stainless steel alloys. These properties permit an intricate casting to be cast to close tolerances, partially heat treated to a machinable condition for finishing, then hardened to high strength levels without distortion by low temperature aging and tempering treatments.

The straight martensitic steels are best represented by Type 410, which in Part I of this report was discussed as a well-known material and the basis of comparison for the newer alloys. Also included was a table showing the compositions of ten commercially available precipitation hardenable stainless steels.

Part III will discuss AM-355 semi-austenitic steel alloy. Here in Part II is a report of the effect of heat treating variables on a precipitation hardenable, martensitic stainless, 17-4PH.

PRECIPITATION-HARDENABLE MARTENSITIC STAINLESS—17-4PH

Wide-spread usage for 17-4PH stainless steel alloy has been found during the past few years in spite of its early history of erratic response to heat treatment. The problems of uneven hardness and low ductility arose from lack of understanding of the transformation behavior of 17-4PH as affected by chemical and thermal conditions peculiar to investment castings. Intensive study of cast bars during the past two years has developed the missing know-how. Specifications are currently being revised to utilize this knowledge, with adequate controls to insure reliability and uniformity. This information has already been incorporated in the ICI FE-5(T) specification.

The martensitic precipitation-hardenable stainless steels have good tensile properties up to 900°F, with higher yield strength than Type 410 at the same hardness levels. Corrosion resistance of 17-4PH is superior to Type 410 and in many respects is comparable to Types 302 and 304.

HEAT TREATMENT

17-4PH is austenitic at annealing temperatures but transforms to a relatively soft low-carbon martensite on cooling to room temperature.

The alloy is usually machined in this condition (solution annealed) with the precipitation-hardening phases held in supersaturated condition.

Aging at 800-1100°F allows the copper-rich constituents to precipitate out of solution, thus hardening and strengthening the material. This aging also tempers the martensite matrix.

SOLUTION ANNEALING

Annealing or, more accurately, solution annealing of 17-4PH is accomplished by heating to 1875-1925°F, holding for one hour per inch of maximum thickness (30 minutes minimum), and quenching in oil or air. During quenching martensite begins to form at about 275°F (depending on chemistry) and the transformation is virtually complete at 90°F. Maximum hardness in this condition is 36 Rockwell C.

PRECIPITATION HARDENING, OR AGING

Aging consists merely of reheating the solution annealed material to a suitable temperature in the 800-1100°F range for approximately 90 minutes, followed by air cooling. For investment castings the optimum temperature is about 925°F for developing maximum strength with adequate ductility. Hardness after aging at 925°F should be 40-45 Rockwell C.

Lower aging temperatures give equivalent strength but lower ductility. Higher temperatures produce lower strength levels with increased ductility and toughness. Since the hardening and strengthening is a precipitation phenomenon, excessive temperature and prolonged time at temperature will produce overaging with a drop-off of strength properties.

HOMOGENIZING

Homogenization has been used with mixed success and failure. In the investment cast condition, 17-4PH

is usually in a heterogeneous condition, only partially transformed to martensite because of the effect of slow cooling rate which depresses the initial martensite formation. In addition, a cored dendritic structure develops during solidification with a tendency toward segregation of the copper content. Grain size is usually quite coarse, an undesirable feature.

All of these troubles are eliminated or considerably improved if homogenization is accomplished by a high temperature solution treatment at 2050-2150°F for 1 to 1-½ hours, followed by air cooling. Copper goes more readily back into solution at 2100°F than it will at 1900°F and coring is essentially eliminated. Normal martensitic transformation occurs during cooling to room temperature. The normal solution treatment which follows creates refinement by transformation back to austenite during heating (complete at about 1660°F.)

However, homogenization by solution treatment at such a high temperature requires very careful furnace atmosphere control in equipment not readily available, and at considerable expense. The alloy scales badly in air at 2100°F. Protective atmospheres which are carburizing, nitriding, or oxidizing may severely damage the alloy. Nearly all "neutral" salt baths and endothermic atmospheres are carburizing. Dissociated ammonia must be controlled at -50°F dew point in the furnace to be successful. Thus, it can be seen that many problems are associated with this operation.

CARBIDE CONDITIONING

A sub-zero cool after casting has been used in an attempt to complete the martensitic transformation, but has not generally been successful.

A conditioning treatment at 1400-1500°F forms chromium carbides and reduces the austenite stability so that the martensite reaction goes to completion on cooling. At this point the alloy is not ideally transformed but the effective chromium content is temporarily reduced. A normal solution treatment at 1900°F then tends to refine the structure and return the chromium into solution in austenite. Thus the 1400°F conditioning treatment followed by solution annealing will have a beneficial effect on the grain structure.

The need for high temperature homogenizing can be further lessened by reducing the copper content to a point where segregation is not a problem. Current specifications have already done this in order to provide satisfactory weldability in the alloy.

Homogenizing remains a useful and successful part of the complete heat treat cycle when maximum uniformity of structure, chemistry, and hardness is sufficiently important. Atmospheric control must guarantee a strictly neutral or slightly reducing condition to avoid significant surface damage.

CHEMISTRY CONTROL

Control of chemistry is critical for development of optimum properties. Current success with 17-4PH castings is based on complete understanding of the interrelations of all elements in this alloy. In brief, the alloy can neither be too stably austenitic nor too strongly ferritic. Neither the copper nor the columbium-tantalum can be too high if proper heat-treat response and a satisfactory balance of properties are desired.

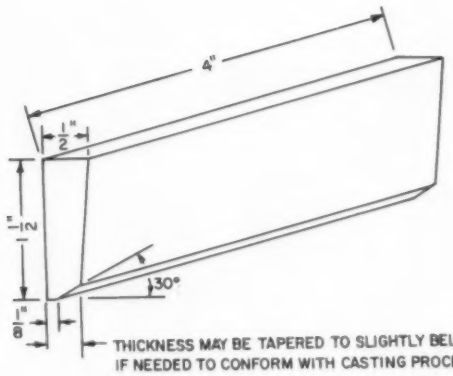
The structure at room temperature after solution treatment should be essentially martensitic with a small percentage of delta ferrite.

Low ductility can nearly always be traced to excessive ferrite content with or without retained aus-

TABLE I — Properties of 17-4 PH with Varying Copper Content

% Cu	Heat Treatment	Tensile Strength Ksi.	.2% Yield Strength, Ksi.	Elong., % in 1"	Red. of Area, %
2.14	HSA	182	162	12.5	24.0
	HSA	176	157	14.0	28.2
	SA	179	157	13.5	38.0
	SA	181	158	13.5	44.4
2.73	HSA	183	160	10.0	19.2
	HSA	182	159	11.5	20.4
	SA	186	158	13.0	35.2
	SA	186	162	13.0	37.1
3.30	HSA	183	160	8.0	17.4
	HSA	184	161	8.5	18.6
	SA	187	162	12.5	43.8
	SA	186	162	12.0	37.2
3.45	HSA	189	165	9.5	19.0
	HSA	189	164	10.0	21.2
	SA	191	168	15.5	43.7
	SA	195	174	15.0	47.1

Heat Treat Key: HSA = Homogenized, solution annealed, and aged
SA = Solution annealed and aged
Homogenize: 2100°F. – 90 mins. – air cool
Soln. Anneal: 1900°F – 30 mins. – oil quench
Age: 925°F. – 90 mins. – air cool



TEST SPECIMEN was specially designed for welding tests. These were cast with test bars in ceramic shell molds.

tenite. Coarse grain structure reduces ductility regardless of chemical balance.

Low hardness nearly always indicates excessive retained austenite. This may be a surface effect due to contamination during heat treatment.

High hardness usually indicates abnormal treatment response due to improper chemistry balance. It may also be a surface effect from improperly controlled heat treatment.

FERRITE FORMATION

Ferrite formation is promoted by Cr, Si, and Cb; also by high pouring temperatures and slow cooling rates. When the delta ferrite content becomes too high, it will be impossible to achieve proper recrystallization during subsequent heat treatment, and poor ductility will result. There appears to be no practical way to eliminate delta ferrite by heat treatment. The safe limits of control on Cr, Sb, and Si depend on the ratio of these ferrite formers to the total content of the austenite formers: Ni, Mn, C and N. For example, Cr, Cb, and Si should not be high when Ni, Mn, and C are low.

Minimum Cr is usually assumed to be 15.5% in order to insure adequate corrosion resistance. It should be remembered that low Ni and C promote ferrite formation just as do high Cr, Cb, and Si. In fact, it is entirely possible that C in 17-4PH can be too low in relation to the other elements, and poor ductility will result.

AUSTENITE RETENTION

Austenite retention on cooling is promoted by the austenite stabilizing elements: C, N, Ni, and Mn. When these elements are too high in relation to Cr, Cb, and Si, a three-phase structure consisting of martensite, ferrite, and retained austenite will exist at room temperature after solution annealing. The retained austenite grain size will be coarse because it was formed at high temperatures during solidification, and will not change during subsequent heat treatment. Refrigeration treatments, mentioned before, can in some cases achieve transformation of this retained austenite. At higher than normal levels, Cr may become a potent austenite stabilizer. In this event, depletion of Cr by carbide formation at 1400°F may readjust the effective chemistry balance to allow a more normal martensite transformation on cooling.

OTHER ELEMENTS

Cu, Cb, P, and S all contribute to dendritic segregation and should be kept low for this reason. The presence of Cb in the cast alloy is desirable in that it causes a lower annealed hardness, which is important for machining considerations. Cb also inhibits the overaging tendency of the material. This allows greater freedom with the time-temperature cycles and, in the case of intentional overaging, permits the aging to be done at higher temperatures, resulting in higher ductility without lowering the tensile strength excessively.

LIMITS FOR COPPER

The desired upper limit for Cu is the maximum content which will permit restrained welding without underbead cracking. The minimum limit should be at the point where attainable strength values begin to drop off significantly.

Establishment of these limits has been the subject of a joint research project between WaiMet Alloys Company and Armco Steel Corporation. A special low-copper master heat of shot was produced at WaiMet, with composition as follows (Fe=balance):

C	Mn	Si	P	S
.024	.37	.46	.006	.015

Ni	Cr	Cu	Cb + Ta	N
4.35	15.93	2.22	.20	.027

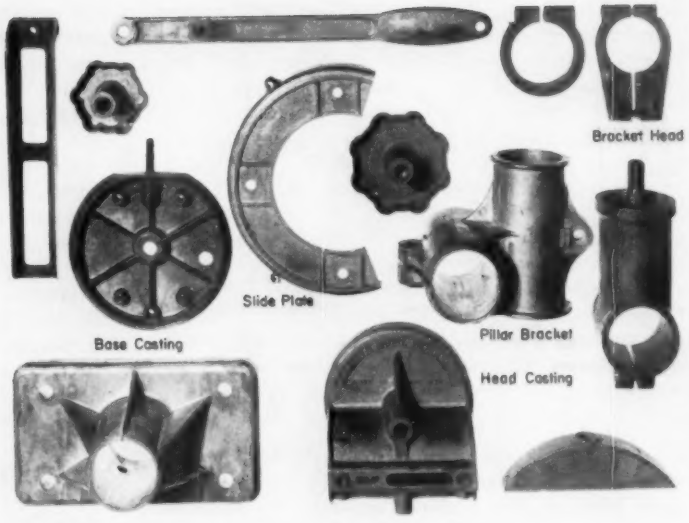
Specially designed weld test specimens were investment cast together with test bars in ceramic shell-type molds. The molds were preheated at 1900°F and pouring temperature was 3000°F. The test specimens were center-gated and threaded bars with 1" gage length, heat-treated at 0.330" diameter, then finally machined to 0.252" diameter test section before aging. Copper additions were made in the furnace during remelting of the master heat and recovery was determined by analysis of each mold casting.

Results of restrained welding tests by Armco Steel Corporation indicated an upper safe level of Cu would be about 3.75%. Results of tensile tests by WaiMet Alloys Company indicated a safe lower limit on Cu at about 2.75%.

Results of tensile tests are given in Table I. At each Cu level, test bars were homogenized (2100°F, 90 minutes, air cool), solution annealed (1900°F, 30 minutes, oil quench), and aged (975°F, 90 minutes, air cool). Duplicate bars from the same molds were merely solution annealed and aged, using the same cycles. Table I indicates that, for this project, the homogenization was undesirable from the standpoint of strength and ductility values obtained. It has not been determined if this was a result of improper atmosphere control during homogenization.

Photos courtesy Zinc Development Association, London

ONLY ZINC DIE CASTINGS could produce this precision tool at a low price.



FIFTEEN DIE CASTINGS go into the assembly of each Selecta Home Master Work Shop. Thirteen of them are shown.

DIE CASTINGS make the Home Workshop

- **MAKE 15 ZINC DIE CASTINGS**
- **TAP 14 HOLES**
- **ASSEMBLE**

That's almost the entire story in the manufacture of England's Horstmann & Sherwen "Selecta Home Master Work Shop".

Why were these 15 parts die cast? Because after simple tapping operations they would be ready for use.

Then why were zinc base die castings chosen? Because no other alloy which could be die cast would give the required strength, rigidity, and light weight.

To get the rigidity required and make the tool look like a small machine tool, the vertical support and the horizontal traverse members were made as centerless ground tubes instead of solid bars. Then too, the required finish and accuracy could be obtained in this way at moderate cost.

The initial design required a series of movements of the work head. Two rotational axes at right angles to each other, a slide for feeding the tool into the work, and a further sliding movement along the horizontal tube to permit the cutter traverse through the work. This was gotten with a head casting which slides on the tube and key, and carries the slide plate on a pivot.

Adequate accuracy in the sliding bore was a problem. It was solved by a special technique of core extraction which left the hole round and parallel to within 0.001 and with an excellent surface finish. This eliminated a boring operation.

The slide plate has a die cast circular scale for indexing, and carries the slides and tool carrier.

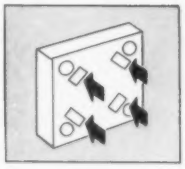
The main pillar bracket was a problem. It had to hold the horizontal slide tube at right angles to the column, provide adequate rigidity, and permit necessary adjustment. This was all secured by careful placement and size of ribs, meticulous die construction and careful design of the bosses. This part requires no machining at all. A radial scale is cast in to permit indexing of the horizontal tube.

The main, vertical, column is supported by a base casting, heavily ribbed to provide rigidity. A set screw locks the column in place.

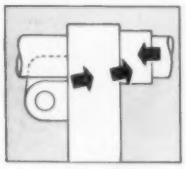
Another special casting is the bracket head. This part supports, and holds, the electric drill used as a power source. This part had to accept the nose of many differently designed drills. The final design shown proved quite satisfactorily.

This entire machine used 15 different die castings which weigh about 11 pounds. All of the die casting is so accurate, and the finish, especially in the cored holes, so good that only tapping is needed to finish the parts.

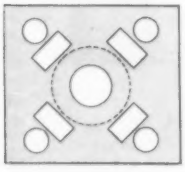
Zinc die casting has made the machine economically possible. Any other method of parts manufacture would have been far too expensive.



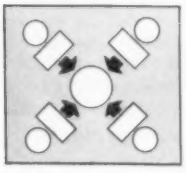
1. Each corner link is a strong, self-contained support for both plate and die.



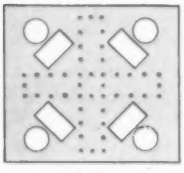
2. Short and direct transfer of loads on each corner minimizes bending stresses on the moving die platen and back plate.



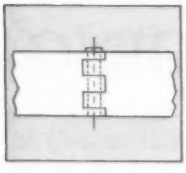
3. Reduces the area of unsupported moving die plate. Helps eliminate flashing and potential cracking of dies.



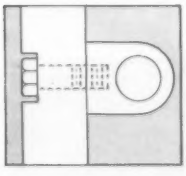
4. Prevents weaving of the link center axis (crosshead) and consequent unequal loading.



5. Permits a large area of both horizontal and vertical bumper pin ejection pattern.



6. Corner positioning of each link assembly results in equal and straight line loading of all pins and bearings in the link pivots.



7. Toggle anchors are bolted to the back and traveling platens. They are not subject to weld breaks or breakage as part of a casting.

FOUR-CORNER LOCK-UP

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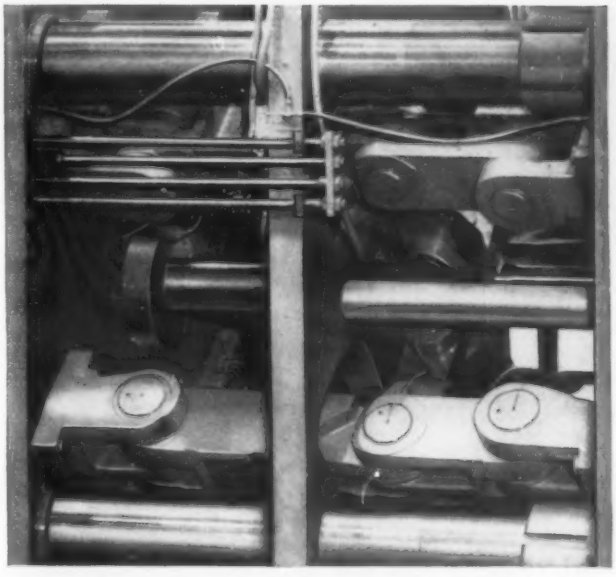

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EACH LANDING GEAR on this jet transport must be able to withstand an impact load of nearly 300,000 lbs. This load is transmitted through the landing gear piston.
Boeing Airplane Company Photo

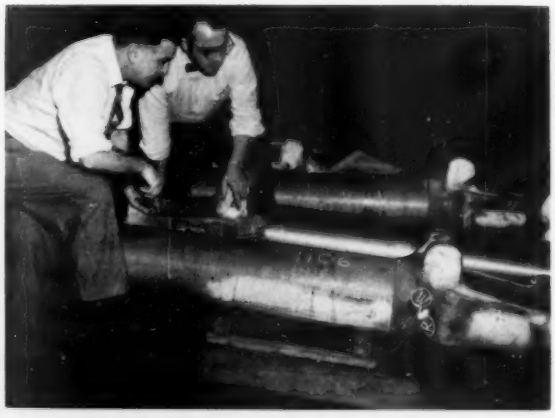
EXTRUSION REPLACES A FORGING

. . . for a critical structural application

USING EXTRUDED STEEL pistons in the manufacture of commercial jet landing gears has saved time and solved metallurgical problems. That's what the Cleveland Pneumatic Tool Company discovered when they began to make landing gear pistons for huge jet transports.

At first they made the pistons for the landing gears from solid forgings. Since most of the piston is a hollow cylinder, 45% of the 1460-lb. forging was lost just boring out the inside.

Another problem was the high rejection rate caused by the small defects at the forging die parting line. These small defects and the parting line itself reduce the ductility of a forging. Since only a 2% design margin is used on the major gear components to save weight on the massive system, reduced ductility can't be tolerated. It lowers the ability of the part to absorb abnormally high loadings, or even repeated normal loadings.



VALUE ANALYSIS supervisor, Harry Pritchard, and engineering specialist, Vince Hudacko, examine one of the extruded pistons as it is received from the vendor.

EXTRUDING IMPROVES PROPERTIES

A better method for forming the stock is to extrude the cylindrical section. An AMS-6407 steel billet is forced into a die to form the fork-shaped lower end of the piston. Then the remaining metal is forced back over a ram to form an extruded cylinder 50 inches long. The improvements:

- No cracks from a die parting line, ductility is improved, fewer rejected parts.
- Mechanical properties are improved and consistent throughout the extruded length.
- Less machining scrap. Before machining the piston weighs 980 lbs. That's 480 lbs. less than the all forged billet.
- Three hours machining time saved.

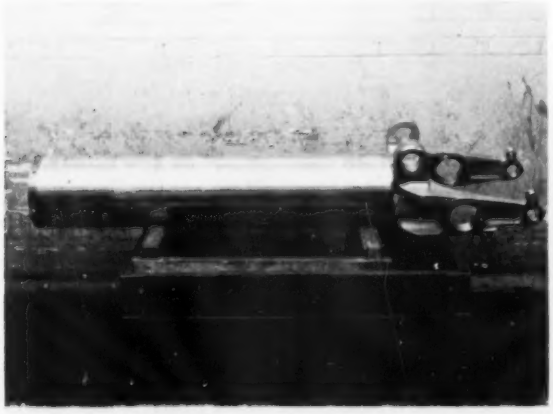
RIGID INSPECTION REQUIREMENTS

Detailed machining and testing operations are needed to make the piston and guarantee its performance. Cameron Steel Co. forms the stock and rough turns the outside diameter. Then they remove, heat treat, and test a sample of the stock. It must show a hardness of 46 Rockwell C and an ultimate strength of at least 220,000 psi across the extruded grain. As a ductility check, the average reduction in area in the strength test must be at least 12%. The minimum allowable area reduction is 8%. An ultrasonic test is made to find sub-surface defects. Then the extrusions are shipped to Cleveland Pneumatic.

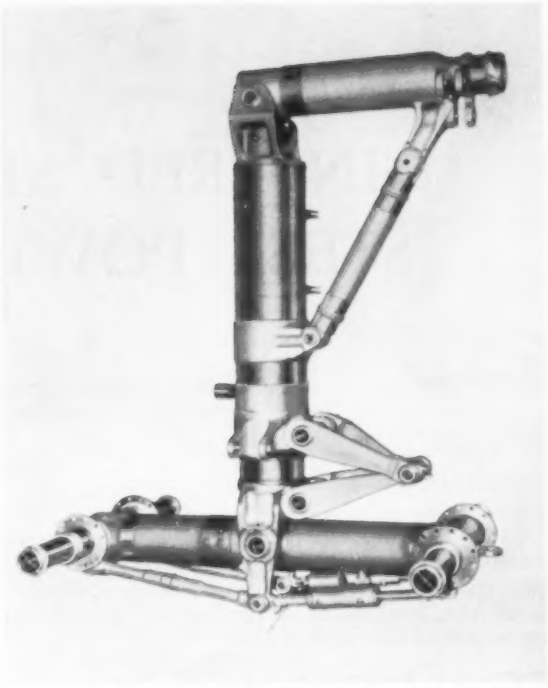
GUARD AGAINST FATIGUE FAILURE

The piston is normalized, hardened, and tempered between machining operations. Within three hours after grinding the diameters, they bake the piston to relieve residual stresses. Unrelieved residual stresses in a part this large are sometimes great enough to fracture it, even if no other load is applied.

The piston is shot peened to further guard against fatigue failure. The outside diameter is polished and chromium plated to resist corrosion and abrasion. The other surfaces are polished and cadmium plated. It is baked to reduce hydrogen embrittlement, and finally, the chromium is ground to a final outside diameter of 9.96". Final inside diameter is 9.375".



CAREFUL FINISHING procedures insure that this completed piston will not fail in service. The billet weighs nearly 1000 lbs. before machining. Final piston weight is 225 lbs.



THE OUTER CYLINDER (vertical member) hides nearly all the piston in a completed assembly. The axle beam (horizontal member) to which the wheels are attached fits on the lower part of the piston.

Boeing Airplane Company Photo

THE PISTON holds oil, air, and a hydraulic dampener inside the outer cylinder. The air cushions bumps while rolling on the ground, the oil and dampening valve absorb landing forces.

SINTERED STAINLESS STEEL POWDERS

PART II

By R. L. SANDS, *The B.S.A. Group Research Centre; and*
J. F. WATKINSON, *Director and Gen. Mgr., B.S.A. Metal Powders, Ltd.*

PART I of this report appeared last month and discussed background investigations, experimental details, and the green properties of stainless steel compacts. Additional results obtained in this investigation are presented here in Part II.

SINTERED PROPERTIES

A typical variation of strength with sintering temperature for a stainless steel powder is shown in figure 3. The onset of sintering at about 800°C, and the small but definite increase in strength that takes place between room temperature and 1472°F (800°C), are most interesting. The present investigation was, however, confined to sintering temperatures between 2012 and 2372°F (1100 and 1300°C), as this is the range of major interest in commercial practice. Table IV shows the properties obtained from the different powders when they were sintered at 2102°F (1150°C) for 1 h. With the best powders it is possible to obtain tensile strengths of 50,000 psi for specimens compacted at 30 tons/in² and sintered at 2102°F (1150°C).

In Fig. 4 the influence of sintering temperature upon the properties of powder 347L is illustrated. The results are typical of the low-silicon austenitic stainless steel powders. Fig. 5 shows results for a 316L powder containing 2½% silicon. The relationships between sintering temperature and shrinkage, strength, and ductility, are essentially linear up to a certain critical temperature, above which each of the properties increases rapidly. This should not be confused with the inflection at about 1472°F (800°C) in the strength/sintering-temperature curve shown in Fig. 3.

The interesting feature of the low-silicon austenitic stainless steel powders is that the linear characteristics are completely maintained in the range 2012-2372°F (1100-1300°C). This is very important for the dimensional control of pressed parts and allowing for variations in the temperature of industrial sintering furnaces. The high-silicon powders do not show this simple linear relationship. This militates against their use for high-density parts, irrespective of their lower compressibility.

The 12% chromium steel, 410L, is interesting in that besides possessing high strength, the sintered components are quite hard and can be heat-treated to about 40 Rockwell C Hardness. This favors the use of the powder where components are required to have both corrosion and wear resistance. The results (Table V) quoted from Hoeganaes Sponge Iron Corporation, support this view.

The fall in hardness at the highest sintering temperature is believed to be due to the slower cooling cycle which these specimens underwent.

The ductility of specimens sintered below the critical temperature is always low, of the order of 5%. It is difficult to detect significant trends in these ranges, but 316L appears to be better than 304L or 347L. However, the low ductility is most likely to be due to nitrogen pick-up, and sintering in hydrogen or in a vacuum would be expected to give higher ductilities.

Although lithium stearate is primarily added to increase green density and decrease die wear, it has also been claimed that it exerts a beneficial influence during sintering. Lithium, which possesses a strong desiccating effect, can act as an atmosphere scavenger. Similar claims have been advanced for calcium stearate. So far as is known, any action lithium stearate may exert upon the sintering atmosphere takes place

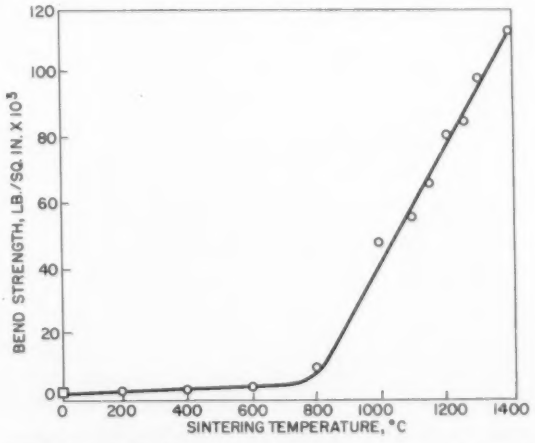


FIGURE 3 STRENGTH of 304L powder compacted at 30 tons/in², as a function of sintering temperature.

before the sintering temperature is reached, and thus its influence should be confined to counteracting the effects of air entrapped within the compact. In the present experiments, a white deposit, presumably lithium oxide, was formed in the cold zone of the furnace. Apart from an apparent slight lowering of the critical sintering temperature, the presence of lithium stearate has little effect on the sintering of stainless steel powders. However, as a result of the substantial improvement in green density associated with additions of lithium stearate, such specimens are always markedly stronger for a given compacting pressure and sintering treatment. Compacting pressure has a large influence upon sintered properties. Increasing the pressure reduces the shrinkage but increases the density and strength.

EFFECT OF COINING

Porosity in a sintered compact can be eliminated if the appropriate sintering temperature is used. However, it is essential to consider this problem with regard to the restrictions on sintering temperature imposed by the necessity for maintaining dimensional accuracy, and the maximum compacting pressure imposed by die-life economics. If 50 tons/in^2 be taken as the maximum compacting pressure likely to be used in a press on production, and 1% linear shrinkage be taken as the maximum allowable for the maintenance of accurate dimensions, then it does not appear feasible to produce parts having densities higher than about 6.9 g/c.c. This implies up to about 12% porosity when a single pressing and sintering cycle is adopted.

The problem of producing high-density material, without exceeding the limitations referred to above, is common to stainless steel powders. A widely employed method of raising the density of powder-metallurgical products is by coining, i.e. re-pressing in a die after presintering. Preliminary results with 316L of an investigation into the density that can be obtained by coining are shown in Fig. 6. It appears likely that under optimum conditions, e.g. the addition of lithium stearate before compacting and the adoption of a sintering temperature lower than that used to obtain the values shown in Fig. 6, the density could be raised above 7.0 g/c.c. Sintering in hydrogen before coining would be expected to show greater advantages on account of improved ductility. Further work is being undertaken on this aspect.

GENERAL REMARKS

The level of recorded properties is lower than those obtained on the same alloys in the wrought form. If, however, the powders are hot or cold worked to give fully dense material, the properties are then equal to or better than those of the commercially wrought alloys. Techniques for the production of dense material include the forging of sintered "uses", the extrusion of powder-metal billets, and the direct rolling of strip from powder.

Table VI compares the stress-rupture properties of dense 347L prepared from prealloyed powder, with those of the conventionally produced material of the same composition.

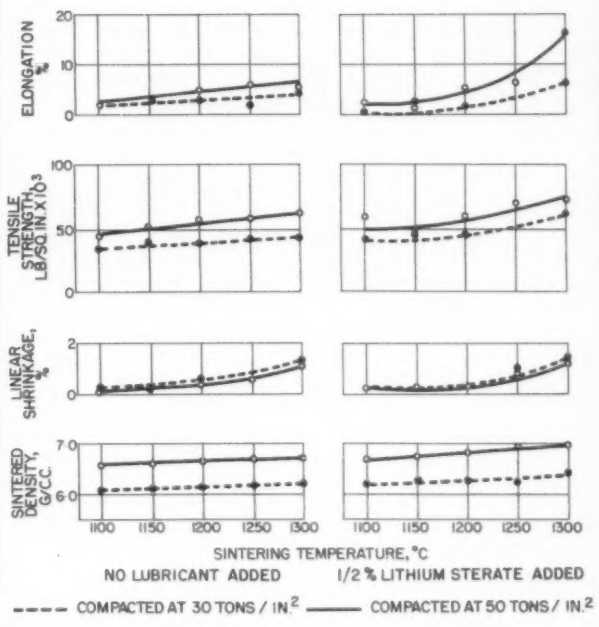

ELONGATION, %
TENSILE STRENGTH, LB/SQ IN X 10^3
LINEAR SHRINKAGE, %
SINTERED DENSITY, G/CC
SINTERING TEMPERATURE, °C
NO LUBRICANT ADDED
1/2 % LITHIUM STERATE ADDED
COMPACTED AT 30 TONS / IN.^{2}
COMPACTED AT 50 TONS / IN.^{2}

FIGURE 4 INFLUENCE of sintering temperature on the properties of 347L powder.

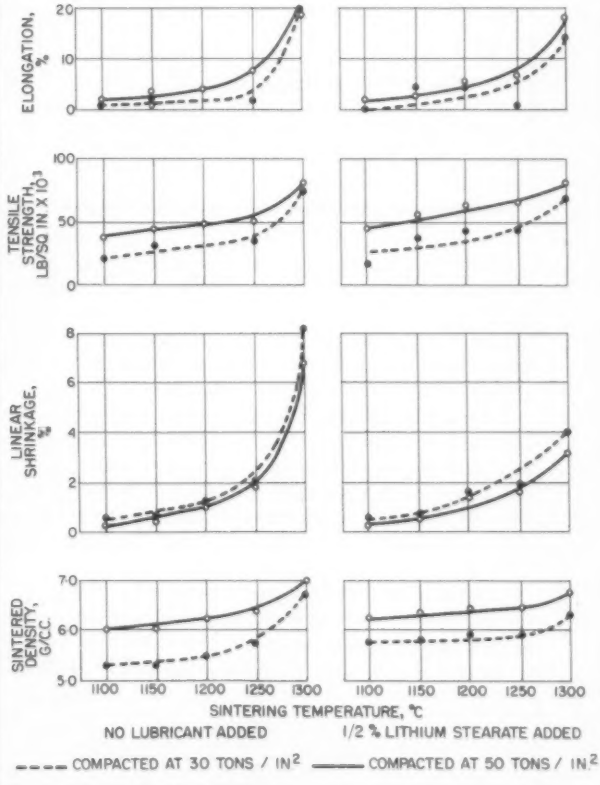

ELONGATION, %
TENSILE STRENGTH, LB/SQ IN X 10^3
LINEAR SHRINKAGE, %
SINTERED DENSITY, G/CC
SINTERING TEMPERATURE, °C
NO LUBRICANT ADDED
1/2 % LITHIUM STEARATE ADDED
COMPACTED AT 30 TONS / IN.^{2}
COMPACTED AT 50 TONS / IN.^{2}

FIGURE 5 INFLUENCE of sintering temperature on the properties of 316L powder, containing 2½% silicon.

TABLE IV.—Properties after Sintering at 1150°C for 1 hour ½% lithium stearate added

Powder	Compacting Pressure, tons/in²	Linear Shrinkage, %*	Sintered Density, g/c.c.	Bend Strength, lb/in²	Tensile Strength, lb/in²	Elongation, %
304L	30	0.42	6.20	71,100	58,800	2
	50	0.38	6.78	111,300	72,800	2
316L	30	0.51	6.43	93,600	57,500	5
	50	0.40	6.95	130,000	76,600	7
347L	30	0.25	6.25	84,300	45,700	3
	50	0.20	6.79	113,300	56,400	2
410L	30	0.43	6.09	93,000	52,500	1
	50	0.30	6.61	145,000	98,200	1

*Measured against size of green compact.

TABLE V.—Hardness of Sintered 410L (Not Heat-Treated After Sintering)

Green Density, g/c.c.	Green Strength, lb/in²	Sintering Temp.		Rockwell C Hardness	Sintered Bend Strength, lb/in²
		°F	°C		
6.3	1450	2000	1090	22	107,800
6.3	1450	2050	1120	24	110,800
6.3	1450	2100	1150	26	139,500
6.3	1450	2250	1230	18	179,000

ERRATUM

In Part I of this article appearing last month, the compacting pressures in Table III for "No Lubricant Added" and "½% Lithium Stearate Added" should read 30 and 50 tons/in.², respectively for each case. Also, the particle sizes in Table II are given in microns.

While this equivalence in properties may not be of great practical importance in the case of 18:8 and 18:12 type alloys, it does open up considerable possibilities in the production of precipitation-hardening steels of the 15:7 and 17:4 types, which are difficult to produce by conventional techniques.

It has been shown that the newer austenitic stainless steel powders, suitable for processing under typical industrial conditions, have adequate green strength and can give approximately 60,000 psi tensile strength with 5% elongation. To achieve these properties, the silicon content of the powders must be kept below 1%, and careful control of the particle shape is also essential to ensure adequate green strength. Further, the nickel and chromium contents must be controlled with regard to the amounts of silicon and molybdenum present, to ensure good compressibility.

Alloys representative of the three most useful compositions, namely 304L, 316L, and 346L, are all commercially available in suitable form for the production of high-performance sintered components from Hoeganaes Sponge Iron Corp.

TABLE VI.—Stress-Rupture Properties of 347L

Applied Stress, tons/in²	Temperature, °C	Time to Rupture, hours	
		Conventional Alloy	Powder Product
18	600	200– 400	200
15	600	800–1200	1000
13	600	1500–3000	5000

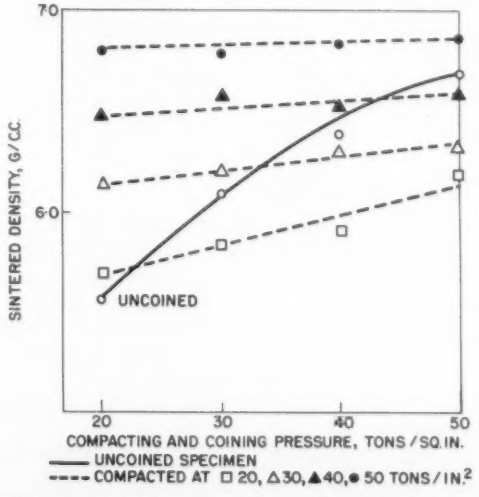
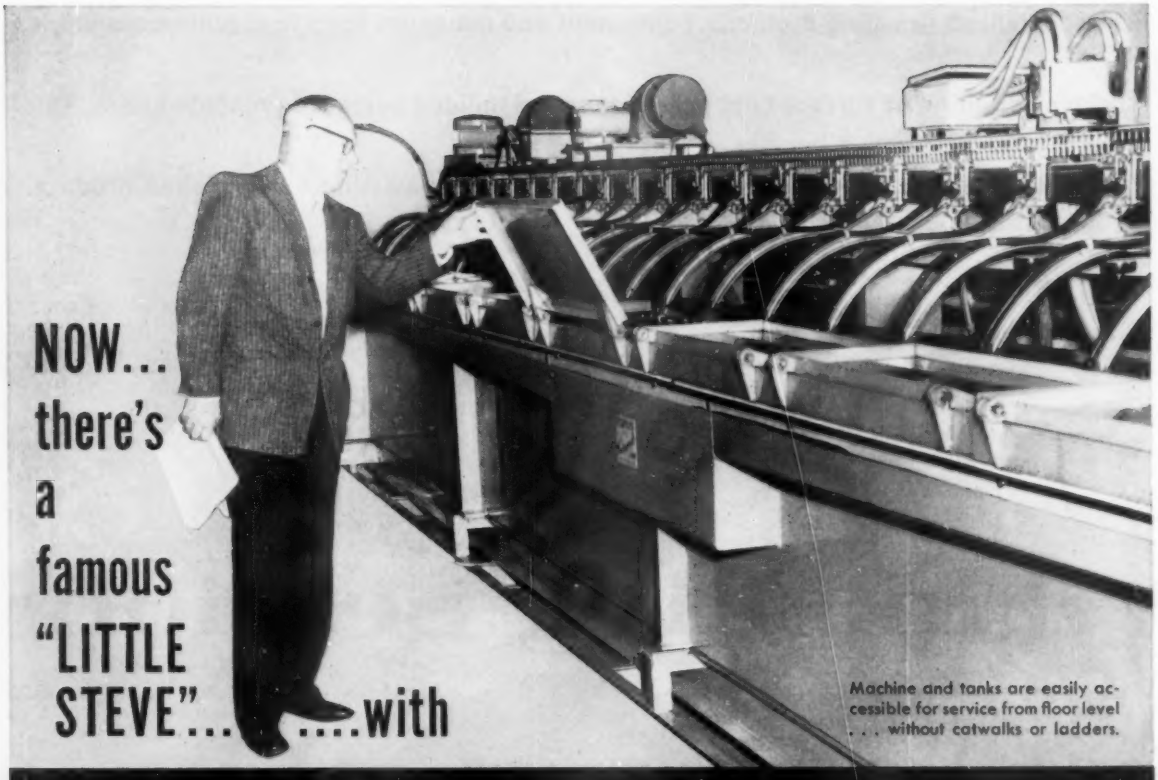


FIGURE 6 EFFECT of coining on the sintered density of 316L powder.

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Finishing Section

SAVE $30,000 A YEAR
DEBURRING DIE CASTINGS ..Page 51
VIBRATORY FINISHING .....Page 54



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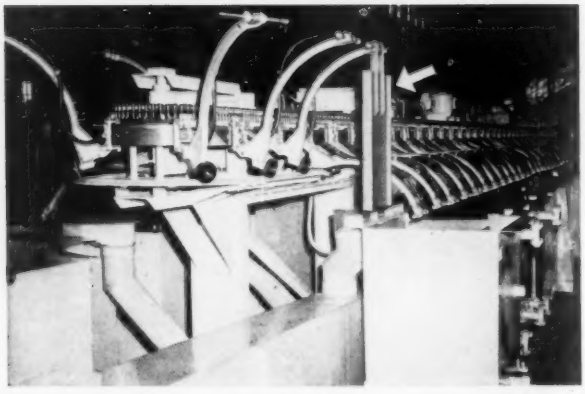

Rack size and distance of lift shown by metal plate.

- Offers all the economies of automatic plating on limited and medium-volume operations.
- Permits use of narrower-width tanks for rack plating, thereby reducing space requirements.
- Features smooth, dependable operation and proven design simplicity for which Stevens equipment has long been famous.
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SAVE $30,000 A YEAR DEBURRING DIE CASTINGS

BIG SAVINGS IN THE PRODUCTION of small air-cooled gasoline engines are being made by Clinton Engines Corporation. Costs have been cut $30,000 a year by eliminating one hand operation: deburring of die castings.

One of the largest manufacturers of 2-cycle and 4-cycle engines, the company sells its products to approximately 750 equipment manufacturers throughout the world. These engines power a wide variety of products—lawn and garden equipment, carts, generators, pumps, and many other applications for farm and industry. The company also makes chain saws and outboards. Many of the engines and accessories are die cast.

Deburring of these die castings—essential to the dependable performance of the engines they are used in—was originally set up as a hand operation (Fig. 1) because no completely dependable mechanical process was believed available. Quality control had to take precedence over cost. But by switching to blast methods, better quality deburring is done than ever before and at lower costs.

Now deflashing comes right along with deburring. Trim edges are smoothed, there is improved appearance in the finished casting, and the matte surface obtained with the blast process provides improved paint adhesion.

Savings occur primarily because the die castings, instead of individually handled, are blast deburred in large batches. For example, 875 reed plates (Fig. 3) are perfectly deburred in 6 minutes. This time saving cuts deburring cost per piece from $0.0050 to $0.0006. On a yearly schedule of 900,000 this cuts costs by $3,960.

Engine bases (Fig. 2) are now deburred in batches of 70 in 3 minutes time at $0.0024 each. Compared to former cost of $0.0061, savings on 900,000 die castings amounts to $3,330 a year.

These savings are considered typical of approximately ten items now handled by the new method.

FIGURE 1 FORMER DEBURRING METHOD involved individual handling of castings at a high labor cost.

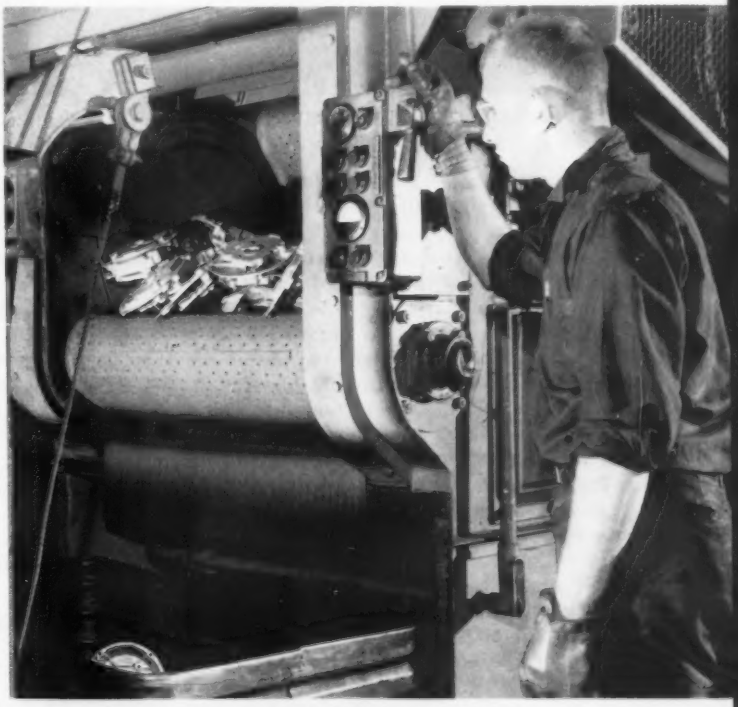


FIGURE 2 BLAST DEBURRING finishes 70 engine bases in 3 minutes. Both time and money are saved.

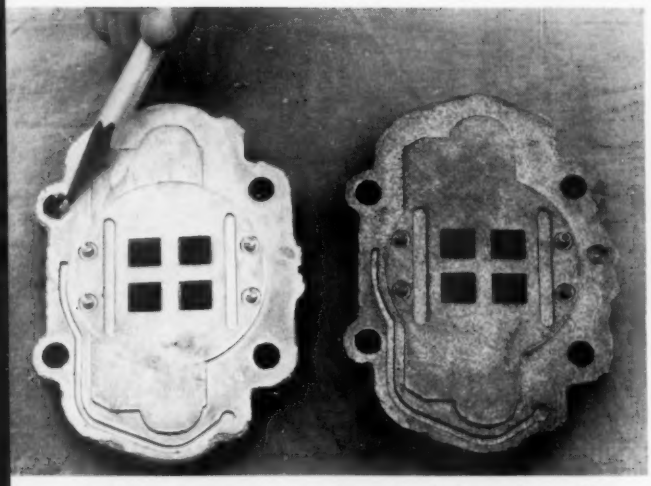


FIGURE 3 REED PLATE die casting before and after blast descaling. Matte finish produced also improves paint adhesion.

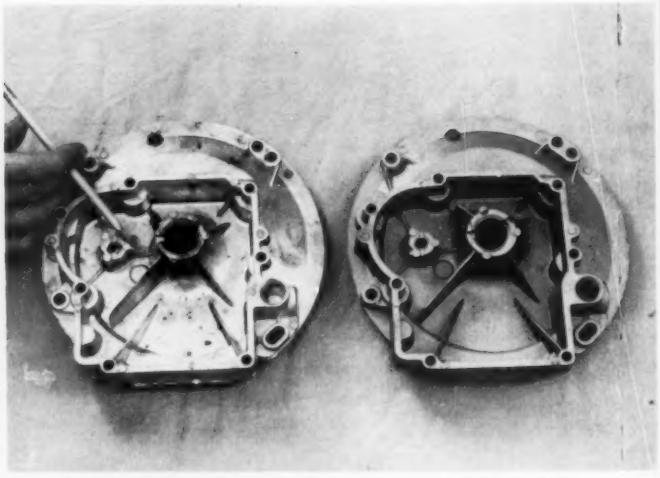


FIGURE 4 ENGINE BASE die casting before and after blast deburring. Blast deburring saved $3,330 a year on this part.

FIGURE 5 BLAST DEBURRING UNIT is adjacent to the trimming operation to simplify material handling.

Significantly, total cost of the new equipment—blast machine, automatic loader and dust collector—was less than ⅓ of this amount.

In addition to its deflashing and deburring duties, the blast equipment is also used for rust removal on various cast iron parts.

The blast machine is the standard 6 cu. ft. barrel manufactured by the Pangborn Corporation. It is positioned adjacent to the trimming operation (Fig. 5) so that trimmed parts drop alongside the blast machine's loader. From here the loader is easily filled, push-buttons pushed and the loading-deburring-unloading cycle set in operation. Both material handling and the blast process are so simplified that the trim-press operator handles both machines without difficulty or delay.

S-170 steel shot is the abrasive used. The blast barrel employs a vaned, centrifugal wheel with a 15 h.p. motor to throw 22,000 pounds of abrasive an hour. It incorporates abrasive cleaning and recycling equipment for effective removal of flash particles, burrs, fines and dust from the good abrasive which can then be used over and over again. A cloth bag dust collector exhausts the deburring operation, serving the air wash system in the abrasive separator and effectively preventing spread of dust.

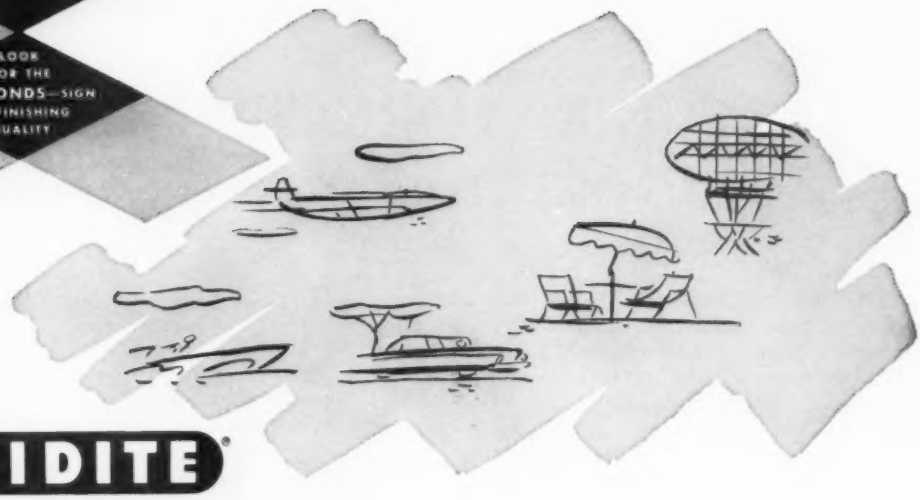
Both operating costs (mainly abrasive and labor) and maintenance costs for the blast deburring machine are considered extremely reasonable.

HOW BLAST DEBURRING CUT COSTS

Reed plates:	
Former method, each	$0.0050
Rotoblast, each	0.0006
Savings per piece	$0.0044
Pieces per year	900,000
ANNUAL SAVINGS	$3,960.00
Engines bases:	
Former method, each	$0.0061
Rotoblast, each	0.0024
Savings per piece	$0.0037
Pieces per year	900,000
ANNUAL SAVINGS	$3,330.00

These examples are considered typical of approximately ten items. Total savings computed at $30,000 per year.

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY



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4 ECONOMY

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VIBRATORY FINISHING

. . . may mean lower costs and faster production

THE VIBRATORY FINISHING process finishes many castings rapidly and economically when they cannot be processed by other methods. The reason for this is the gentle and total agitation between the parts and media which occurs in the vibratory hopper. The hopper is loaded with parts, media, compound, and water in much the same way as conventional barrel finishing equipment. However, the hopper does not rotate. Instead, it is mounted on an eccentric which moves the hopper in a circle about ¼" in diameter at from 1200 to 2500 rpm. This motion produces the following advantages:

- Media reaches deep recesses and areas that are difficult or impossible to finish by other methods.
- Delicate parts can be processed safely.
- Parts with appendages don't lock together.
- Heavy parts don't impinge and nick one another.
- Inspection can be made at any time without stopping the machine. Just reach into the hopper and lift out a part at any time.

The vibratory process also shows promise in lengthening the fatigue life of parts. The violent agitation of the media produces something akin to shot peening. This blends in the small nicks which cause stress concentrations, a major reason why metals fail early under fatigue loading. Tests show that the life of some heavily fatigued parts is increased 40% by the vibratory finishing process.

SPEEDS PRODUCTION

Although vibratory finishing equipment may cost about 2½ times more than barrel finishing units of the same capacity, they are much faster. Capital investment for a given volume of work may be lower, depending upon specific requirements.

Faster finishing means that work flow on a production line can be more uniform, with no pile-up at the finishing operation. In fact, vibratory finishing can be installed in almost any mass production line as a standard tool.

WHY VIBRATORY FINISHING WORKS

The machine's eccentric moves the hopper in a small circle. The component of vertical acceleration resulting from this circular motion is primarily responsible for the total agitation in the hopper.

At 1200 rpm an eccentricity of ⅛" imposes a maximum downward acceleration on the hopper of about 5 g's. This is five times the downward acceleration of a freely falling body.

Since the parts and media in the hopper assume a free fall when the hopper is accelerated downward faster than 1 g (this occurs during most of the cycle from -90° to 90°, figure 1), the hopper is accelerated downward five times faster than the parts and media. This makes the parts and media "float" upward with respect to the bottom of the hopper.

After the eccentric has moved through the 90° position (figure 1) the hopper assumes an upward acceleration. It is still moving downward, but with diminishing velocity—hence, upward acceleration. This upward acceleration is just as severe as the downward acceleration, but in the opposite direction. Therefore, after a fall of about ¼", the parts and media are forced down into the hopper with a force five times greater than gravity.

At the upper extreme, an eccentricity of 3/16" at 2500 rpm imposes an acceleration of nearly 33 g's.

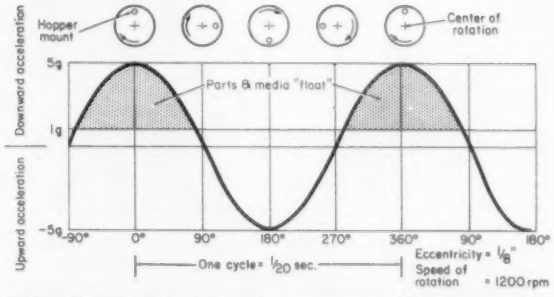


FIGURE 1 ECCENTRIC throws parts and media into free fall during each cycle, producing total agitation in the hopper.

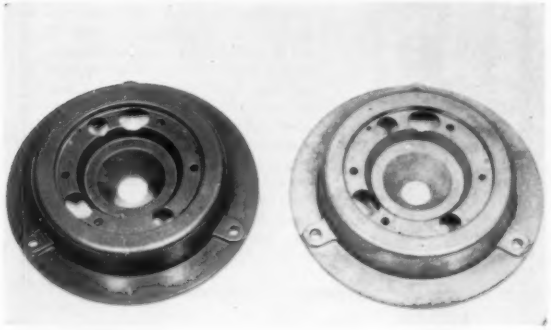
As the parts and media are "floating", the top layer is being thrown in the direction of rotation. This makes the whole mass inside the hopper circulate in the same direction as the eccentric.

Other factors also have an effect on the scrubbing action in the hopper. Since parts usually weigh more than the individual pieces of media, the parts have more momentum. This makes them move in relation to the media when the hopper is accelerating and decelerating the mass. The friction between the pieces also effects their movement.

CASE HISTORIES

The following examples from the laboratories of the Productive Equipment Corporation show how vibratory methods cut finishing time and overcome some of the disadvantages of other processes.

Trial and error testing is used to determine the media-parts ratio and finishing time. Experience in using the process makes the trial times for new pieces very short in most cases.



MACHINE PART

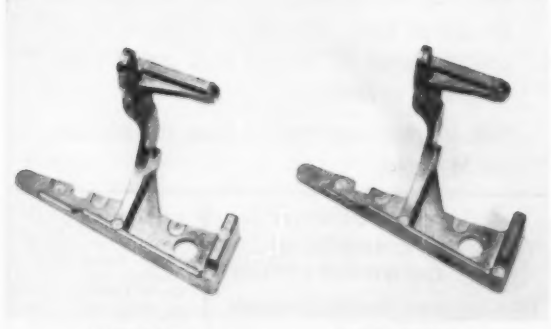
Considerable flash and burr had to be removed from the interior of this aluminum die casting. It formerly could only be finished by hand because the parts nicked badly in a barrel finisher. Now it is vibratory finished in 45 minutes with aluminum oxide. The charge is 40% parts, 60% media, 14 oz. burnishing compound, and 1½ gallons of water in a 14 cu. ft. hopper.

PUTTER HEAD

This cast bronze putter head must be deburred, cleaned for plating, and have a radius put on the shaft attachment neck. Barrel finishing took 28 hours, and the parts hit and nicked one another. It is vibratory finished in 6 hours with preformed shapes at 1750 rpm. They use 40% parts, 60% media, 10 oz. descaling compound, and one gallon of water in a 10 cu. ft. hopper. Preformed shapes are used so that the media does not stick in the shaft neck.

DOOR HANDLE

Flash and grinding wheel marks had to be removed from this aluminum die cast door handle. Barrel finishing time was 3½ hours. Now it is vibratory finished in one hour with Honite abrasive media, 40% parts, 60% media, 8 oz. of burnishing compound and one gallon of water in a 10 cu. ft. hopper. Honite is fast cutting and was used because of the heavy flash and wheel marks. Burnishing compound was used to restore color.



BRACKET

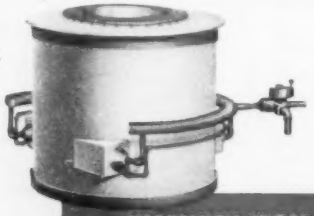
The flash must be removed and corners rounded on this aluminum die cast bracket. It took 3½ hours to finish in a barrel finisher, and the parts tangled. It is vibratory finished in 30 minutes using aluminum oxide with 50% parts, 50% media, 10 oz. of burnishing compound, and one gallon of water in an 8 cu. ft. hopper. Small size aluminum oxide shapes are needed because the part is small. Burnishing compound puts a little shine on the part.

FINISHED UNFINISHED

WARWICK FURNACES

Deliver Better Metal Faster!

All WARWICK Furnaces, no matter how large or how small are designed and engineered to melt metal better, faster and at great savings in production costs. Antiquated melting equipment will "up" your production costs tremendously. Investigate the NEWEST, best and most efficient non-ferrous metal melting furnaces available. They are made in sizes to fit any desired capacities . . . and designs to assure utmost efficiency and economy for YOUR production. Here are just a few examples. A letter or phone call will bring immediate information on the complete line.



WARWICK IRON POT MELTING FURNACES FOR ZINC, ALUMINUM, LEAD or DIE CAST

These furnaces are highly recommended as breakdown furnaces for zinc and aluminum die casting and permanent mold plants. They also excel as holding furnaces. They can be supplied either with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of automatic or manual controls and oil or gas fire. Capacities from 50 to 9000 lbs. aluminum; 125 to 23,000 lbs. zinc; other white metals corresponding.

WARWICK STATIONARY CRUCIBLE MELTING AND HOLDING FURNACES FOR ALUMINUM

Built especially for use in permanent mold and die casting plants where molten metal is dipped from furnace with a hand ladle. Melting is done in crucible (no iron pick-up). Thoroughly insulated to protect the operator from heat. Oil, gas or combination oil-gas fire. Capacities 200 to 2000 lbs. in aluminum. Available with full automatic controls.

Write for full information today.

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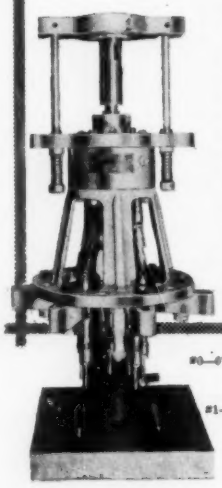
ERRINGTON

UNIVERSAL JOINT ADJUSTABLE TAPPING & DRILLING HEAD



Here's another hi-speed production tool from Errington. This dependable tool is adjustable to any pattern of holes . . . is available with 4 or 6 spindles. Positive clutch drive and reverse. Head made of the best grade sand Cast Aluminum with hardened and ground gears and spindles (made in one piece). Full grooved ball thrust bearings at all thrust points and Oilite bronze radial bearings. *Remember to do more . . . better . . . faster . . .* rely on Errington Hi-Speed Production Tools.

#0—0" to ¼" Tap Capacity
Min. centers 11/16"
Max. Pattern 5¼"

#1—7/32" to ¼" Tap Capacity
Min. centers 1⅛"
Max. Pattern 8"

LESS THAN ½ MINUTE TO CHANGE HEAD FROM DRILLING TO TAPPING OR TAPPING TO DRILLING

Write for Complete Information

ERRINGTON Mechanical Laboratory, Inc.
Established 1891
Main Office and Plant: STATEN ISLAND 4, NEW YORK

specialists in metal surface treatments

KENVERT® Chromate Coatings, Bright Dips and Chemical Deburrings—Aluminum, Copper, Brass, Zinc, Cadmium, Zinc Die Castings

KENVERT Compatible Brighteners — Zinc, Cadmium

KENVERT Buffing Compound Removers
Synthetic Detergent Type — All Metals

CONVERT TO KENVERT ON DIE CASTINGS

Kenvert 45, a non-fuming pickle for aluminum castings; Kenvert 55, a chemical polish and burr remover for zinc die castings; Kenvert 11X, olive drab directly on zinc die castings; Kenvert ZB, tenacious direct chemical black; all available as powders.

Write for general summary Fact Sheet with details for over 50 products.

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NEW PRODUCTS *continued from page 23*

TURRET DRILL

BURGMASTER CORP.—This automatic, bench model, 6-spindle turret drill provides automatic power feed and turret indexing. The machine sets the pace, rather than the operator. This increases production on operations requiring precision drilling, reaming, tapping, etc.

Controlled infinitely variable power feeding with pre-selective individual spindle speeds automatically shift to insure machining efficiency, fine finish, and long tool life.

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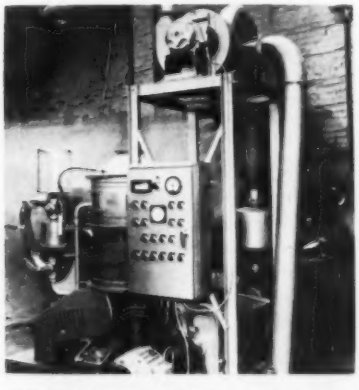
SHELL SAND COATER



SHALCO DIV., NATIONAL ACME—The No. 150 Shalco-Fordath Automatic Shell Sand coating plant for resin coating sand to be used in shell core molding is the first completely packaged unit of its kind. All auxiliary and control equipment is integrated and mounted on a heavy steel bed.

The plant is completely wired and piped. Installation requires only connecting air lines and electric power to the control panel.

Circle No. 239 on Reader Service Card

BARREL FINISHING MACHINE

BAIRD MACHINE COMPANY—The Finishmaster horizontal barrel finishing machine requires only 5 square feet of floor space. Lightweight doors of armor plate can be lifted by hand so that all loading and unloading equipment can be carried over the top of the machine. A limit switch permits jogging, but not running of the barrel when the guard is raised.

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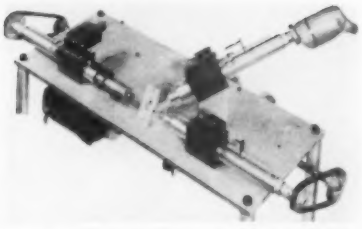
DRILL UNIT

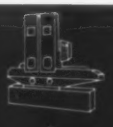


COMMANDER MFG. CO.—This Multi-Angle drill unit with a drill capacity of ¼" in steel provides unlimited mounting flexibility to handle angle or off-line drilling jobs. A two-way air cylinder provides both feed and return of the spindle. Any length stroke may be set up to the 4" capacity.

Circle No. 241 on Reader Service Card

continued on next page

1 MACHINE
1 OPERATOR
AND 1 PASS



...that's all it takes with a

Hammond
FLAT-FINISHER

Grinding • Polishing • Deburring

Available with 1 to 6 heads in 6", 8", and 12" widths.

Here's truly high production, uniform, economical finishing of metal or plastic flat work such as sheets, bars, strips, stampings, and extrusions.

Hammond Flat-Finishers grind, polish, and deburr in ONE operation. Users nationwide report production increases and cost reductions through use of these machines.

AUTOMATIC AIR TENSIONING: maintains correct tension on abrasive belts and conveyor belt. VARIABLE SPEED CONVEYOR: rate of feed is adjustable from 0 to 60 FPM. WORK HOLDERS: hold-down rolls, electromagnetic platen and various types of conveyor belts. AMMETER CONTROL: an ammeter for each head allows operator to determine and maintain the polishing pressure necessary for a uniform finish and longer belt life. V-BELT DRIVE: allows abrasive belt speed to be changed to suit the work. MICROMETER DIAL: controls heads for required depth of cut.

SEND SAMPLES . . . one finished and several rough. You will receive a complete Engineering Report and Production Analysis without obligation.

Hammond Machinery Builders INC.
1642 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

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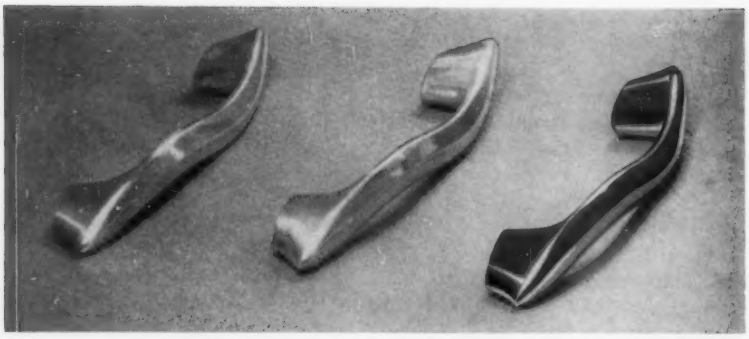

Three stages in the finishing of a zinc base die casting. Casting at left was buffed. Center casting was buffed and electrocleaned in Oakite 195. Casting at right was buffed, electrocleaned in Oakite 195, and plated. Note that center casting retains full buffed lustre and color after its electrocleaning in Oakite 195.

New electrocleaner for zinc die castings assures brighter plate... and cuts rejects!

Plating of zinc base die castings now becomes a more dependable, more economical operation with the introduction of Oakite 195, a *non-etch* anodic cleaner.

More dependable because the casting surface is not etched and its color not changed or darkened. Soils and films are effectively removed, yet the castings retain their buffed lustre. To help further in preparing the way for uniformly good plating results, this new electrocleaner has excellent rinsability in hot or cold water, and low foaming tendency.

And more economical by far, because of the sharp reduction in rejects due to poor pre-cleaning.

Oakite 195 can be used with direct, reverse and periodic reverse current, in still tanks and fully automatic set-ups. Where only a single solution tank is available, it is being used to clean a variety of metals—zinc, steel, brass, copper.

For more information about this important new development in cleaning before plating, write for descriptive folder F-10466 to Oakite Products, Inc., 34G Rector Street, New York 6, N. Y.

OAKITE®

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

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NEW PRODUCTS *continued*

TEMPERATURE RECORDER

ASSEMBLY PRODUCTS, INC.—This miniaturized temperature recorder operates directly from a thermocouple without signal amplification. The meter movement, calibrated to match the thermocouple, is essentially the same as those used in sensitive API panel pyrometers.

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DEW POINT TRANSDUCER

ALNOR INSTRUMENT CO.—Type 7600 dew point transducer measures dew points from –20 to 60°F. The unit is particularly suited for outlet measurement of endothermic gas generators used in controlled atmosphere heat treating.

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INTERNAL RECESSING TOOL

NOBUR MFG. CO.—The Intramatic tool exceeds in capability the inherent limitations of conventional internal recessing tools. Developed on a new principle, the new tool will automatically perform operations previously considered impossible. One basic model accommodates holes from ¼ to 2".

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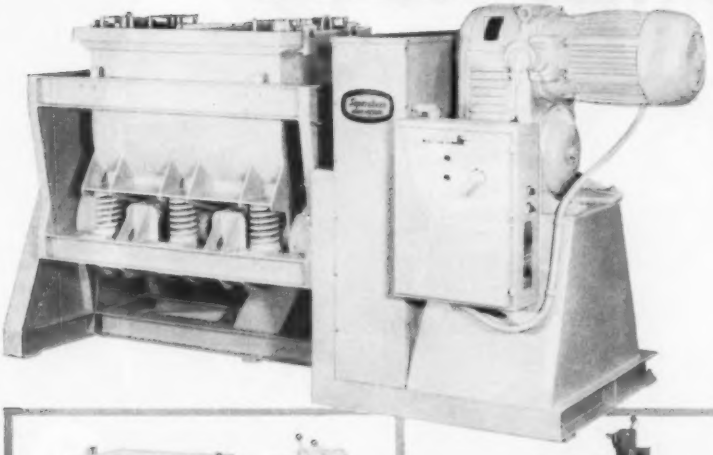
UP TO 100 TIMES FASTER FINISHING WITH

ALMCO

VIBRASHEEN



ALMCO'S FULL LINE OF NEW VIBRASHEEN MACHINES

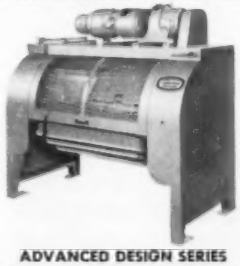
MODELS VT-717 — 712
(18 and 12 cu. ft. capacities)
Ideal for large components requiring fixtures or a large volume of smaller parts.

MODELS VT-77 — 75
(7 and 5 cu. ft. capacities)
Efficiently deburrs and finishes parts in quantities suitable for medium size production runs.

MODELS VT-72 — 71
(2½ and 1 cu. ft. capacities)
Popular unit for firms requiring precise finishing of a wide variety of parts in small lots.

MODEL VT-70
(3 qt. capacity)
Bench model ideally suited for miniature bearings, extremely small gears, stampings, etc.

WORLD'S LARGEST LINE OF PRECISION FINISHING EQUIPMENT



ADVANCED DESIGN SERIES
Thirteen models are available in this series featuring capacities of from 5 to 40 cu. ft., each equipped with variable speed drives. (Infinite from 6 to 30 rpm's.)

SPINDLE MACHINES
Designed for fast precision finishing of complex, high quality components such as gears, bearing cages, spline shafts, rotors, on continuous production "in line" basis.

CUSTOM DESIGN BARRELS
Special large diameter barrels are available to accommodate extra large parts. Fixtures hold parts to assure complete, precise finishing of all crevices and surfaces.

SEND FOR NEW ALMCO CATALOGS ON BARREL FINISHING MACHINES MEDIA, AND COMPOUNDS

ALMCO

PRECISION FINISHING

Queen Products Division • King-Seeley Corporation
71 E. MAIN STREET, ALBERTA LEA, MINNESOTA

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SHOCK TREATMENT!

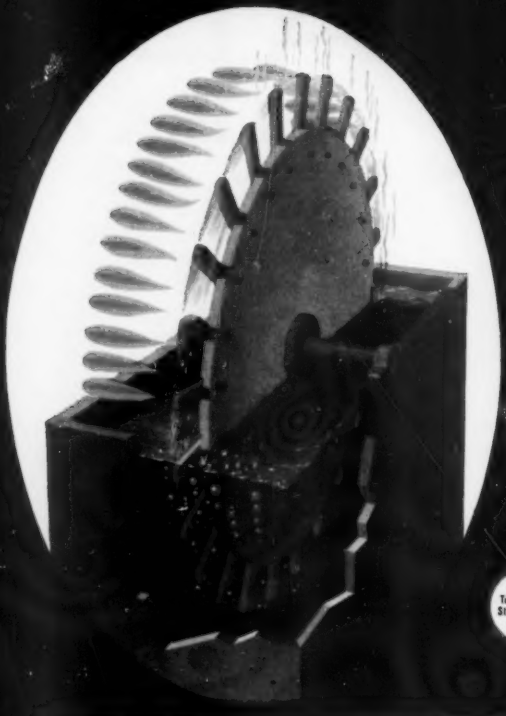
VACUUM-DEGASSED

THERMOLD® AV

DIE CASTING DIE STEEL

SHRUGS OFF THERMAL SHOCK

IN HEAT CHECKING TEST



Test samples heated to 1200° F. in this revolving fixture and repeatedly quenched in 70° F. water

A full cycle every 50 seconds

Here's proof of vacuum-degassed Thermold AV's improved resistance to thermal shock. Compare the results between vacuum-degassed and regular electric arc air melted samples shown at right. Note the superior resistance to heat checking evidenced in the vacuum-degassed test pieces. It's easy to see why Universal-Cyclops Thermold AV now assures you of longer die life, longer runs, finer finish . . . *more profitable production.*

Vacuum-degassed Thermold AV is a cleaner steel. Greater internal soundness (Reflectoscope proved), higher polishing quality, and greater resistance to fatigue and heat failure have made it today's ultimate in die casting die steels.

Call your nearest Universal-Cyclops Service Center for more information or for fast, off-the-shelf delivery. It's available in a complete range of sizes . . . including giant 4-ton blocks.

UNIVERSAL CYCLOPS

UC STEEL

STEEL CORPORATION

EXECUTIVE OFFICES: BRIDGEVILLE, PA.

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EXAMINE THESE TEST SAMPLES!

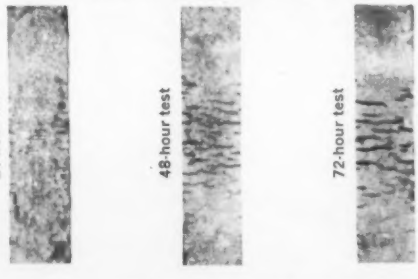
All samples shown were made from the same heat, part of which was vacuum-degassed, and the balance cast in normal fashion in air.

✓ **VACUUM-DEGASSED ARC MELTED SAMPLES**

Note that the samples were hardly affected by the thermal shock test.

✓ **NORMAL ARC MELTED SAMPLES**

Note the typical heat checked surface of these samples, subjected to the same test.



ORIGINAL, UNRETOUCHED LABORATORY PHOTOGRAPHS

TOOL STEELS • STAINLESS STEELS • HIGH TEMPERATURE METALS

PMM

useful literature, catalogs, manuals

qualified readers may obtain any of these technical publications by circling the numbers on the reader service cards.

PROCESSES

146 **Investment Castings**—PRECISION FOUNDERS INC.—8-page technical brochure discusses the features of investment castings, includes design and alloy selection data.

147 **Die Castings**—NEWTON-NEW HAVEN CO.—Data sheet lists the ADCI product standards for die cast lettering and ornamentation.

148 **Die Castings**—PRECISION CASTING CO.—Brochure describes what they offer as a supplier of die castings.

149 **Die Casting**—AMERICAN SMELTING & REF. CO.—48-page technical booklet presents a detailed discussion on the gating of zinc die castings for various shapes, sizes, and dimensions.

MATERIALS & EQUIPMENT

150 **Box Furnaces**—GENERAL ELECTRIC CO.—4-page bulletin describes high temperature box furnaces for operation at 2300°F or 3200°F.

• **Toggle Clamps**—DETROIT STAMPING CO.—36-page catalog lists a full line of general purpose and special use toggle clamps, includes templates with detailed dimensions. Send letterhead request to 330 Midland Ave., Detroit 3, Michigan.

152 **Vacuum Furnaces**—KINNEY MFG. DIV.—24-page progress report on new developments in high vacuum furnaces.

153 **Scrap Press**—MILWAUKEE FOUNDRY EQUIPMENT DIV.—Bulletin describes a complete line of scrap briquetting presses designed to convert chips, turnings and borings into high grade scrap. Charted specifications for six models are listed.

154 **Penetrant Inspection**—TURCO PRODUCTS, INC.—"Sneak Preview" pamphlet describes a training film on dye penetrant inspection methods offered for free showing.

155 **Air Tools**—ARO EQUIPMENT CORP.—96-page catalog with specifications and tabulated list of dimensions describes in detail a complete line of portable air tools, self-feed drilling units, air hoists, and special tools and accessories.

156 **Metal Pump**—METAL PUMPING SERVICES INC.—Brochure describes a refractory pump for molten metal, includes dimensioned drawing.

157 **Tool Holder**—ROSE MFG. CO.—Bulletin shows how to prevent smashed fingers from accidental hammer blows by using a tool holder.

158 **Metal Pumps**—WIRE EQUIPMENT MFG. CO., INC.—6-page technical bulletin on molten metal pumps for zinc base die casting alloys.

159 **Die Casting Machine**—DCMT SALES CORP.—Brochure describes a high speed, automatic 15-ton die casting machine.

160 **Die Casting Dies**—INTERNATIONAL TOOLS LTD.—Brochure shows their capacity for making high-quality die casting dies.

162 **Titanium Alloy**—TITANIUM METALS CORP. OF AMERICA—12-page manual on Ti-8A1-1Mo-1V titanium alloy outlines forming procedures and discusses creep, stability, and fatigue properties.

163 **Machine Tools**—BUHR MACHINE TOOL CO.—32-brochure describes a line of multiple operation machine tools.

164 **Air Dryer**—C. I. HAYES, INC.—Bulletin describes a low cost, high volume, gas-air dryer.

165 **Recorders & Indicators**—MINNEAPOLIS-HONEYWELL REGULATOR CO.—48-page catalog lists strip and circular chart recorders and precision indicators.

166 **Vacuum Equipment**—HIGH VACUUM EQUIPMENT CORP.—Data sheet describes portable high vacuum pumping systems.

168 **Vacuum Pumps**—NRC EQUIPMENT CORP.—12-page catalog on diffusion and booster pumps shows speed curves and tabular specifications.

169 **High Temperature Steels**—BABCOCK & WILCOX CO.—6-page folder lists engineering data on 15 steels widely used in high temperature service.

170 **Vacuum Equipment**—VACUUM-ELECTRONICS CORP.—Technical data sheet describes water cooled baffles for use in high vacuum systems.

171 **Temperature Control**—BURLING INSTRUMENT CO.—Bulletin describes a differential expansion type pneumatic temperature control unit, includes table of standard ranges.

172 **Die Casting Machines**—DE WITT LEWIS CO.—40-page catalog describes the full line of Triulzi die casting machines and special presses.

173 **Shell Binder**—MONSANTO CHEMICAL CO.—Technical bulletin outlines the use of an aqueous colloidal silica sol as a binder in the ceramic shell investment casting process.

more Useful Literature on page 62

BRONZE POWDER for GEARS that FIT THE JOB

CONTROL OF OUR DIMINISHING WATER SUPPLY DEMANDS EFFICIENT METERS IN GREATER NUMBER WITH FEWER AND BETTER OPERATING PARTS

Matching metal powder gears, supplied by a custom fabricator* ready for assembly, provide this ROCKWELL water meter gear train with friction-free operation, low parts cost, precision and durability.

Nonferrous powder metallurgy can produce accurate, low-cost components for your products as well.

*The PRESMET Corp., Worcester, Mass.

IT'S NEW!

WRITE TODAY FOR YOUR FREE COPY.

THE NEW JERSEY ZINC COMPANY
160 Front Street, New York 38, N. Y.

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USEFUL LITERATURE *continued*

174 **Vacuum Measurement**—FREDERICKS CO.—12-page bulletin lists a complete line of precision glass and glass-metal components and vacuum measuring instruments.

175 **Weight Calculator**—UDDEHOLM COMPANY OF AMERICA, INC.—Slide-rule type calculator shows the relationships between length, width, thickness, and weight for strip steel.

176 **Conveyor Furnace**—C. I. HAYES, INC.—Information on a conveyor furnace for extremely close temperature control in the 550°F to 2000°F range.

177 **Pressure & Temperature Recorder**—WHEELCO INSTRUMENTS—Technical bulletin describes a combination pressure and temperature recorder which is self-contained and uses a constant voltage source.

179 **Termocouple Switches**—THERMCO ELECTRIC CO.—4-page catalog on new designs in compact, multipoint thermocouple selector switches.

180 **Metal Powders**—LINDE COMPANY—8-page technical bulletin describes a new process for producing spherical metal powders in sizes ranging from 5 to 150 microns.

181 **Temperature Control**—BURLING INSTRUMENT CO.—Bulletin gives a full description of an indicating differential type temperature control.

182 **Aluminum Etchant**—PENNSALT CHEMICALS CORP.—6-page booklet describes a simplified, push-button feed system for solid aluminum etchant.

183 **Radiography**—RADIONICS INC.—Catalog sheet describes a line of cobalt 60 panoramic radiography cameras.

184 **Trim Press**—DAYTON ROGERS MFG. CO.—Technical data on a new method for trimming castings by the "sliding knife" principle.

FINISHING

185 **Wheel Speed Calculator**—HANSON-VAN WINKLE-MUNING CO.—Handy 3 x 5 inch disc calculator determines the surface speed of buffing and polishing wheels. Set the disc to the wheel RPM, then wheel surface speed is read opposite a list of wheel diameters.

186 **Barrel Finishing**—SYNTRON CO.—4-page brochure on barrel finishing machines for deburring, deflashing, grinding, descaling, polishing, burnishing, and drying includes specifications and engineering data. Shows results obtained.

187 **Localized Plating**—PUDDINGTON & ASSOCIATES—Technical data on the Dalic process of selective localized plating.

188 **Chromate Coatings**—MAC DERMID INC.—Selector chart matches the proper chromate coating to the type of finish desired.

continued on page 64

HOW ELSE WOULD YOU MAKE IT?

plus .0005" minus .0000"

These are some of the *cast* tolerances on this complex mounting frame. GE design engineers specified Zamak–"because of the close tolerances we needed and could get...***without machining.***"

Close tolerances are only one reason Zamak was specified. This mounting frame provides the proper dimensional relationship between many critical components used in the instrument. It must be dimensionally stable to insure continued accuracy; it must withstand heat, humidity, sand, dust and salt spray; it must take rugged, day-in, day-out use. ***"It could only be done in zinc,"*** says the die caster, Peasley Products, Inc.

GENERAL ELECTRIC AMMETER-VOLTMETER FRAME

AWARD OF MERIT

THE NEW JERSEY ZINC COMPANY'S "ZINC DIE CASTING OF THE YEAR" CONTEST

Cost? The answer from GE design engineers: "This die casting has permitted us to supply the market with an instrument whose performance is equal to, or better than, previous designs, and at the same time has reduced cost through greatly reduced machining operations."

Zamak gives you more for less.

How else would you make it?

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

HORSE HEAD PRODUCTS

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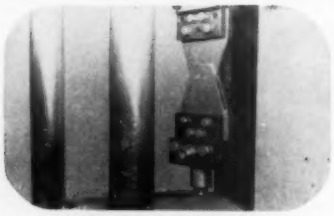
So you need a metallurgist...

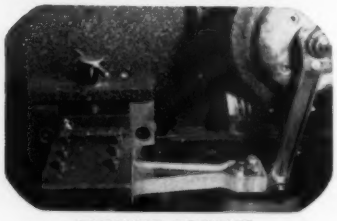
what's your problem?

FATIGUE ?



AXIAL TENSION FATIGUE

ROTATING BEAM FATIGUE



FLEXURE FATIGUE

Fatigue testing is one of our specialties.

Without obligation, send for our brochure and price lists covering complete metal testing and research services. If your problem involves chemical composition, physical-mechanical properties or metallurgical requirements.

Call: LUdlow 8-4161

MCL

METAL CONTROL LABORATORIES

INCORPORATED

2735 E. SLAUSON AVENUE

HUNTINGTON PARK, CALIF.

The Leading Metallurgical Laboratories on the Pacific Coast

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USEFUL LITERATURE *continued*

189 **Feed Units**—BUHR MACHINE CO.—Brochure lists engineering specifications on hydraulic feed units.

190 **Grinding & Finishing**—SALES SERVICE MFG. CO.—8-page booklet describes a line of precision grinding and finishing machines.

191 **Electroplating**—HANSON-VAN WINKLE-MUNNING CO.—24-page technical bulletin gives a description of 18 electroplating processes including three new nickel processes.

192 **Alkaline Stripper**—OAKITE PRODUCTS, INC.—Information on a new alkaline-solvent compound for stripping acrylic, alkyd, and other resistant paint finishes.

193 **Marking & Numbering**—THE ACROMARK CO.—13-page booklet describes marking and numbering machines including dies, inks, parts, and supplemental equipment.

194 **Spray Painting**—CONFORMING MATRIX CORP.—Brochure on a whirling gun automatic spray machine for economically painting round, deep-draw, and intricately designed parts.

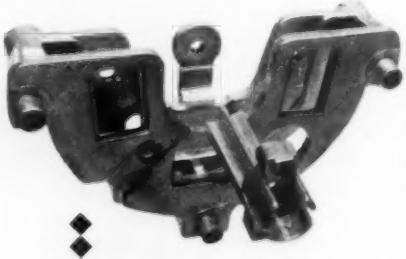
196 **Grinding Equipment**—CHICAGO RUBBER CO., INC.—16-page catalog lists data on the selection and application of contact wheels and industrial rolls for coated abrasive grinding and finishing.

197 **Color Finishing** —ACROMARK CO.—4-page catalog lists color filling and parts printing machines for color decoration of volume production.

PEASLEY wins an Award of Merit in

New Jersey Zinc Company's

"DIE CASTING OF THE YEAR CONTEST"



To bring GE's award winning Ammeter-Voltmeter into reality, Peasley used zinc as the best metal to die cast to close tolerances.

The right alloy and the proper craftsmanship combined to give GE an improved mounting frame at a lower cost.

The Ammeter-Voltmeter is just one example of Peasley's know-how. Contact Peasley before your next Die Casting job.

Service since 1946.

PEASLEY PRODUCTS, INC.

990 Honeyspot Rd. Stratford, Conn.

Phone: EDison 5-7378

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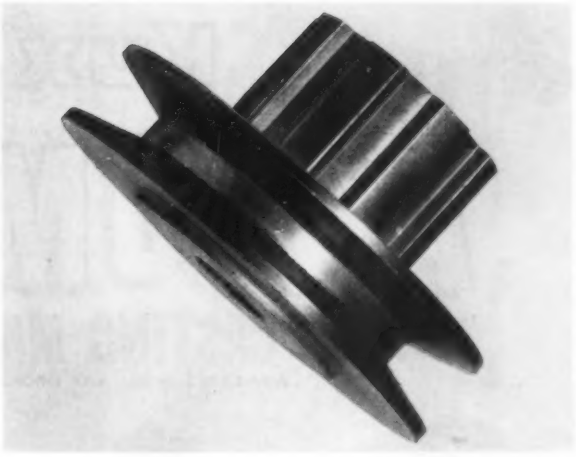
PRECISION METAL MOLDING

DESIGN FOR THE PMM PROCESSES



V-GROOVED PULLEY SINTERED AS ONE PIECE

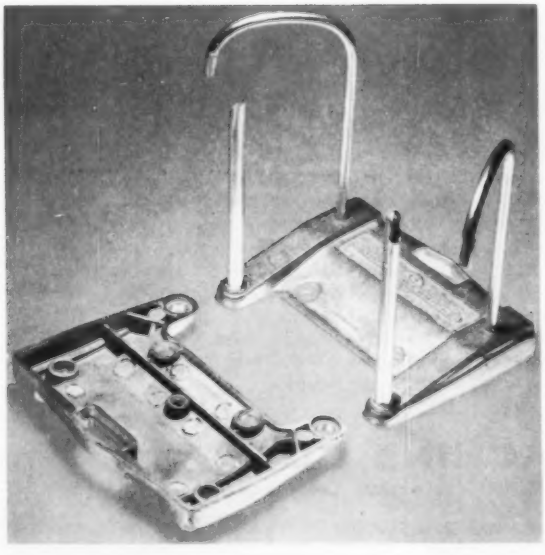
TWO PARTS SINTERED AS ONE. It's a V-grooved pulley that Amplex Division of Chrysler Corp. combines with a splined hub pulley. Brazing and welding are avoided in assembling the two parts.

In this Precision Metal Molding process, high tooling costs are involved. But in considering the production quantities required, piece costs are low. Previous methods of manufacture meant the parts were cut from bar stock, notched, milled, bored and smoothed. Operating costs were high.

Now the parts are sintered in one operation. It increases speed of production by eliminating assembly operations.

The sintered pulley, because of part-to-part dimensional uniformity, has a more positive drive than the machined parts. Elimination of secondary operations makes it possible to produce more parts in a shorter period of time.

STRONGER-CHEAPER ZINC FILE BASES



NEITHER STEEL, PLASTIC OR PORCELAIN was as practical as zinc for this streamlined flip-over arch file base.

With bases die cast of zinc, reject rate is about 1%. Dies last longer than with previous methods. Bases don't split or break except under abnormal abuse. Sections are designed thin and surfaces are hard and smooth. The zinc base is durable and ready for final assembly in the as-cast condition.

The arch file was first made by Globe-Wernicke Company some time prior to 1941. The base was forged of steel, was heavy and required finishing of rough edges. The four corner holes had to be tapped. Stamping dies wore quickly and reject rate oft-times increased to 20% after only one year of production.

A porcelain base was the second material tried. Scrap rate remained high. Parts were heavy and hard to ship.

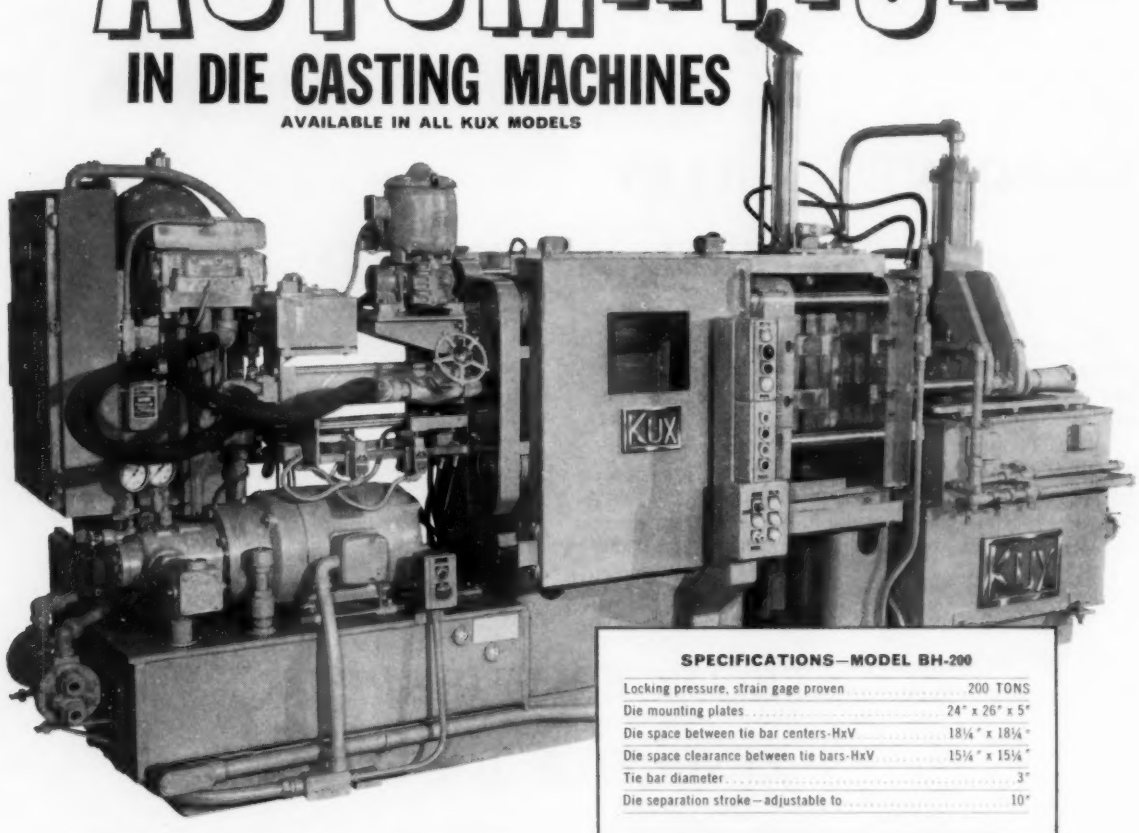
Now made in quantity lots, die casting in zinc has realized many savings for Globe-Wernicke in material and production cost reductions.

Another **KUX** unsurpassed design superiority

AUTOMATION

IN DIE CASTING MACHINES

AVAILABLE IN ALL KUX MODELS



SPECIFICATIONS—MODEL BH-200

Locking pressure, strain gage proven	200 TONS
Die mounting plates	24" x 26" x 5"
Die space between tie bar centers-HxV	18¼" x 18¼"
Die space clearance between tie bars-HxV	15¼" x 15¼"
Tie bar diameter	3"
Die separation stroke—adjustable to	10"

Up to 900 free cycles per hour . . .
500 to 700 casting cycles per hour } AUTOMATICALLY — CONTINUOUSLY

You're looking at the new KUX Model BH200—the 200-ton strain gage proven hot chamber die casting machine, which will continuously produce vast quantities of hardware finish castings with minimum maintenance and down time. Automatic operating mechanism permits a cycle with a full 10" of die movement and 6" of metal injection stroke in 4 seconds. A 6¼ lb. zinc shot can be produced in this heavy duty machine at 1800 PSI injection pressure. Sensing safeties retract the die plate and prevent recycling of machine if there is flash on the die surfaces.

Incorporated into this machine cycling mechanism is a low pressure approach of the moveable die plate, flash sensing switches, air jets for cleaning die faces, casting sweep arm, and die lubricating unit with adjustable interval timing. Also available in cold chamber models for casting aluminum with KUX "AUTO-FEED" system of vacuum die casting.

ADDITIONAL FEATURES in the 28 all-new strain gage proven KUX models are the revolutionary "VAC-U-DIE" and "AUTO-FEED" systems of vacuum die casting—motorized die height adjustment mechanism—and the patented KUX injection pressure multiplier for cold chamber models with injection pressures up to 36,000 PSI and plunger speeds up to 12,000 inches per minute.

KUX MACHINE CO. (Dept. P)
6725 North Ridge Avenue, Chicago 26, Illinois

Write for full details of the 28 all-new KUX models illustrated in the latest KUX Die Casting Machine Catalog.
Circle No. 52 on Reader Service Card

PMM

data offered in this month's ads *qualified readers may obtain any of these free reference materials by circling the numbers on the reader service cards*

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

13. Fluxes—Associated Foundry Services, Inc.—Descriptive Brochure No. 161PM—describes AFSCO's complete range of metal casting aids.

25. Surface Treating—Conversion Chemical Corp.—Fact Sheet—describes over 50 products made for metal surface treatments.

58. Metal Powders—Magna Manufacturing Co., Inc.—supplies aluminum, brass, and copper powders in flake, grain, or atomized form.

73. Die Castings—Premier Die Casting Co.—Facilities Brochure describes die casting services including vacuum die casting.

81. Plating Equipment—Frederic B. Stevens, Inc.—is selling the Little Steve, a vertical lift automatic plating machine.

93. Aluminum Alloys—Wabash Smelting—Selector—offered to those using and specifying aluminum alloy.

95. Multiple-Spindle Heads—Wisconsin Drill Head Co.—Bulletin No. 560—describes Wis-Matic, a drilling, tapping, reaming and boring machine that does all in one cycle.

120. Die Cast Dies—Midland Die & Engraving Co.—does tooling, which includes engraving, milling and manufacturing die cast dies.

2. Die Castings—Advance Pressure Castings Corp.—Book—explains reasons for buying die castings from APC.

3. Iron Powder—Alan Wood Steel Co.—Technical and Application Information on custom-mixed blends and high-purity iron powders.

11. Die Casting Alloy—Apex Smelting Co.—Booklet—shows the compositions, properties, and other data on Apex die casting alloys.

12. Investment Casting—Arwood Corp.—44-page Booklet—to be used as a practical guide to investment casting.

16. Clipping Press—B.I.P. Engineering Ltd.—Technical Data—on a 34-ton, hydraulic trimming press.

20. Die Casting Machines—Eric P. Cahn—Technical Bulletin DD-6—complete details on four column, fully automatic die casting machines.

22. Die Casting Machines—Cleveland Automatic Machine Co.—Technical Data—on its new die casting machine in the 100-ton class.

26. Die Casting Dies—Damen Tool & Engineering Co., Inc.—Brochure—shows their facilities for making die casting dies.

27. Dies & Molds—Delaware Machinery and Tool Co.—8-page brochure shows equipment and facilities for making die casting dies.

28. Standard Unit Dies—Detroit Mold Engineering Co.—Production information—tells how to make die changes in minutes with unit dies.

32. Die Castings—Dollin Corp.—16-page brochure—shows its die casting facilities for both zinc and aluminum castings.

34. Die Compound—Fiske Brothers Refining Co.—Booklets—describe compounds for cleaning castings.

38. Zinc Die Castings—Gries Reproducer Corp.—Bulletins—describe tiny zinc parts made by automatic die casting methods.

39. Castings—Hampden Brass & Aluminum Co.—Brochure—shows its facilities for permanent mold and die casting.

40. Investment Casting—Hitchiner Mfg. Co.—13-page Booklet—explains the ceramic shell investment casting process and shows Hitchiner's facilities.

49. Power Presses—Johnson Machine & Press Corp.—8-page Catalog—covers the complete line of its power presses.

52. Die Casting Machines—Kux Machine Co.—Catalog—describes its entire line of die casting machines.

54. Die Steel—Latrobe Steel Co.—Data Sheet—on an H-13 steel for die casting dies.

55. Die Casting Machines—Lester-Phoenix Inc.—Illustrated Bulletin 102—covers broad range of its die casting machines.

57. Die Castings—Madison-Kipp Corp.—24-page Book—contains problems it has solved, and other product information.

60. Laboratory Services—Metal Control Laboratories—18-page Booklet—describes metallurgical and laboratory services available.

67. Powdered Metal—New Jersey Zinc Co.—Booklet—describes how to design for pressed brass and nickel-silver powdered metal parts.

68. Vacuum Furnaces—New York Air Brake Co.—Bulletin No. 4510—describes new Kinney high vacuum furnaces.

69. Die Casting—Paramount Die Casting Co.—Brochure—on "Designing for Die Casting."

70. Trim Presses—Hannifin Co.—Bulletin—describes high speed hydraulic trimming presses.

71. Direct Chill Process—Permanent Mold Die Co.—Brochure—on its direct chill casting process.

75. Sinterings—Reese Metal Products Corp.—16-page booklet—tells how to cut precision parts costs with the Remet powdered metal process.

76. Die Casting Dies—Richards Tool & Mold Co.—Information—on how its Master-Molds eliminate expensive die sets and other costs.

80. Ladles—Spincraft, Inc.—Data and prices—on stainless steel ladles of non-spill design.

82. Compacting Press—F. J. Stokes Corp.—Bulletin—describes a 50-ton, multiple motion, powder metal press.

continued on next page

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Magnaflake

For Over 20 Years Manufacturers of

METAL POWDERS

ALUMINUM
BRASS • COPPER
FLAKE, GRAIN AND ATOMIZED FORMS

magna

MANUFACTURING COMPANY, INC.
Plant: HASKELL, NEW JERSEY
TEMPLE 5-1200. CABLE: "MAGNAFLAKE"

DATA IN ADS *continued*

84. Pots—Tiffin Foundry, Inc.—Brochure—lists complete line of stock pots.

87. Fire-Resistant Fluids—Union Carbide Chemicals Co.—Booklet—"UC-ON Hydrolubes Spell Safety" to plant facilities.

91. Investment Castings—Vascaloy-Ramet Co.—Booklet—shows the design flexibility of the investment casting process.

92. Non-Ferrous Metals—Hyman Viener & Sons—Chart—of metal specifications available for non-ferrous metals.

96. Chemical Finishing—Allied Research Products, Inc.—Data File—on process chemicals for the metal finishing industry.

97. Metal Finishing—Almco, Queen Products Div.—Catalogs—on barrel finishing machines, media, and compounds.

99. Electrocleaner—Oakite Products, Inc.—Folder—describes an electrocleaner for zinc die castings.

113. Polishing & Grinding—Engis Equipment Co.—Illustrated Price List DV-11—on Di-Profiler for polishing and grinding surfaces.

119. Fire-Resistant Hydraulic Fluids—Celanese Chemicals—Manual—on fire-resistant hydraulic fluids.

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VIENER METALS

Source of Supply
NON-FERROUS METALS

ALUMINUM • BRASS
COPPER • LEAD • LEAD ALLOYS • TIN • ZINC
SPECIAL ALLOYS

INFORMATION ON VIENER METALS ON REQUEST

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HYMAN VIENER & SONS
Dept. PMM
P.O. Box 573 • Richmond 5, Va.
Telephone: Milton 8-6563

FOR CLEANER ZINC AND ALUMINUM CASTINGS

FISKE'S F-456 Fluid Die Compound

A fluid product for spraying in its natural state—less frequent applications permits greater production—keeps dies clean with no build-up—improves surface finish—prevents sticking and soldering—minimizes carbon formation—reduces fumes and smoke.

FISKE'S

Send for particulars. Write today.

Since 1870

METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.
129D Lockwood Street, Newark 5, N. J.
Plants: Newark 5, N. J. and Toledo 5, Ohio

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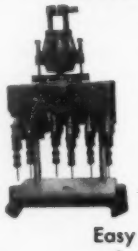
Ettco

DRILLING and TAPPING



Adjustable Spindle Multiple KNUCKLE-HEADS

Easy access for quick set-up. Universal, lubricated ball joint spindle provides complete flexibility while maintaining accuracy and alignment. Fast conversion from drilling to tapping on any drill press.

***Complete Line*-Ettco has the tool for your single or multiple small hole production job.**

ETTCO TOOL AND MACHINE CO., Brooklyn 37, N. Y.

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SYMBOLS OF RESPONSIBLE DIE CASTERS

How To Select Your Die Caster *

Trade marks, emblems and insignia, proudly displayed by a manufacturer, are mere window dressing UNLESS they actually assist You in arriving at a desirable source of supply. As far as die casting purchases are concerned, the above symbols do just that. Here's why:

1. The ADCI symbol, identifying the member companies of the American Die Casting Institute listed here, guides you to a vendor subscribing to the ADCI "Product Standards For Die Castings" written *on an industry-wide basis* to provide you with die casting sources which are:

   a) pledged to the highest standards of business ethics, and

   b) equipped to help you in arriving at a die casting design and an alloy selection which will fill your requirements *at the most economic level of production.*

2. When your die casting is to be made of zinc alloy, it will be a Certified Zinc die casting if the vendor is an ADCI licensee. This means that the die casting will be produced under a voluntary analytical program providing, through unbiased commercial laboratory control, consistent conformance to ADCI and ASTM standard specifications—to assure the maximum mechanical and physical properties inherent in "on grade" zinc die castings.

3. ADCI member companies also participate in the Die Casting Research Foundation—a unique voluntary organization dedicated to the constant improvement of the die casting process and its growing usefulness as a metal working method. Progress in research results in ever-increasing efficiency in die casting production.

These symbols are your guide to the best in die casting *and you will find that the best costs no more*—look for them.

***An asterisk identifies ADCI members in the Die Casting Directory pages.*

ADCI PRODUCT STANDARDS FOR DIE CASTINGS MANUAL

As the representative of the country's leading custom die casting companies, the American Die Casting Institute has prepared the PRODUCT STANDARDS FOR DIE CASTINGS as a service to the customers of the industry.

The Standards are a "must" in specifying and buying die castings at the most economic level. The 45 pages of Engineering, Metallurgical and Commercial Standards, indexed in a durable ring binder, provide you with a qualified guide to the design and purchase of serviceable and quality die castings.

available from the address below at $5.00 each.

AMERICAN DIE CASTING INSTITUTE 366 MADISON AVENUE, NEW YORK 17, N. Y.
MURRAY HILL 2-2925

Circle No. 8 on Reader Service Card

To Cut Costs . . .

PRESS-SINTER-USE

WITH ONLY MINOR REDESIGN, and sometimes without any changes, there are a host of parts made as iron castings which could easily be converted to sinterings. The timing gear illustrated is a prime example.

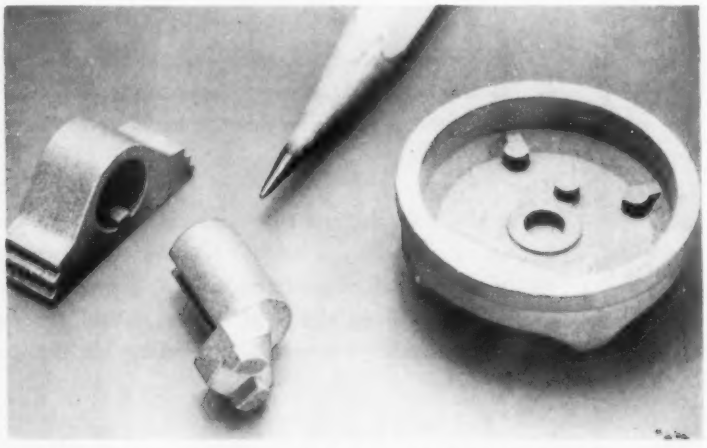
As a cast iron part the gear required finish machining all over. Variations from part-to-part in any run and variations from run-to-run were excessive. The gear didn't respond to heat-treatment and was expensive.

Now it's made by the Amplex Div. of Chrysler Corp. in their Super-Oilite. Because hardened steel tools are used for molding there's practically no piece-to-piece size variation. Because the same set of tools are always used there's no variation in dimensions from run-to-run.

As delivered, the gear is ready for installation in a V-8 engine timing train. If desired it can be heat-treated, and best of all there's a 6¢ saving per gear compared to the finished cast iron gear it has replaced.

WRENCH PARTS INVESTMENT CAST . . .

. . . in molybdenum steel



STRENGTH of an automatic wrench is increased by making these three parts of molybdenum steel.

WHEN CASTING ENGINEERS, INC. suggested the three wrench parts be changed from forgings to investment castings, a 40% savings was realized. Parts shown are made of molybdenum steel—a reversal stud, a pawl and a plate.

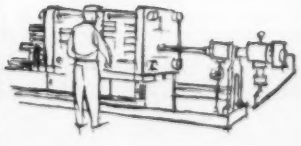
Originally the forged parts required machining of rough edges before they would meet the exacting tolerances required.

Now investment cast, tolerances are exact in the as-cast condition. No machining is necessary to make the teeth, the key or the keyway fit.

Strength and hardness are achieved by heat-treating the molybdenum-steel alloy to a range of Rc 50-55. Strength becomes equal to that of similar forged parts. As hardened, the alloy retains the ductility necessary to meet load requirements of the automatic wrench.

Design & Purchasing

PMM



Producers

5th Annual

DIE CASTING
Directory & Buyers Guide

ABOUT THIS DIRECTORY: As a buyers guide to the die casting industry, this directory includes:

Section I	Custom die casters	—pg. 73
Section II	Geographical listing	—pg. 95
Section III	Equipment and supplies	—pg. 107
Section IV	Finishing supplies	—pg. 119
Section V	Tools and accessories	—pg. 123
Section VI	Tool and die makers	—pg. 126

Only custom die casters who completed a detailed questionnaire to verify accuracy of listings are included in Sections I and II. No captive plants are included. Listings in Sections III through VI were supplied by the manufacturers.

HOW TO USE THIS DIRECTORY: Symbols have been used in Section I to refer to metals and services offered. They are:

Metals Cast

A Aluminum
B Zinc
C Magnesium
D Brass
E Lead

Extra Services

M Machining
F Finishing
A Assembling

Affiliation

° American Die Casting Institute
°° Certified Zinc Plan

To find a die caster in your area, refer first to Section II for geographical listings; then look up the address and data in Section I.

Steel furniture manufacturer gets **these 5 benefits** from Mt. Vernon die castings

CASE HISTORIES FROM MT. VERNON FILES

Subject:

Art Steel Company, New York City

In a major switchover, Art Steel Company makes this handsome Steelmaster Desk with aluminum die cast legs. The companion Executive Chair stands on a die cast aluminum base. Formerly it took 8 parts to assemble each island leg of the desk ... and 14 parts for the chair base. But switching to die cast parts gave Art Metal Company 5 major benefits:

1. Simpler fabrication since all castings are one-piece integral units. No more multiple section subassembly work.

2. Complete freedom in designing due to the many inherent advantages of the die casting process.

3. Corrosion of legs and bases caused by office cleaning detergents no longer a problem. Aluminum die castings stay bright and attractive.

4. Die castings are delivered polished, drilled and tapped, ready for use. Several assembly steps previously required have been eliminated.

5. Because production of legs and bases has been put into Mt. Vernon, valuable production capacity at Art Steel has been freed for other requirements.

More and more, in a great variety of products, Mt. Vernon Die Castings are replacing complex sheet metal assemblies and costly, crude sand castings, bringing significant production economies to the manufacturer. All the knowledge we have gained on this subject is also available to you ... free. Why not discuss your problem with us too. A call to your nearest Mt. Vernon representative will bring you action.

MT. VERNON DIE CASTING CORPORATION
STAMFORD, CONNECTICUT

SALES REPRESENTATIVES
BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St.
BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Grant Eller, 6 East 194th St.
MARIETTA, N. Y.: Mr. Burt J. Meldrum, Olanco Road
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

Circle No. 63 on Reader Service Card

A & A Die Casting Corp.* **
12901 S. Western Ave.
Gardena, Calif.
Metals: B
Services: M, F, A

Aallied Die Casting & Mfg. Co., Inc.
10029 Pacific Ave.
Franklin Park, Ill.
Metals: A, B
Services: M, A

ABCO Die Casting Corp.
330 N. Harding Ave.
Chicago 24, Ill.
Metals: A, B
Services: M, F, A

Ability Die Casting Co.* **
865 N. Sangamon St.
Chicago 22, Ill.
Metals: A, B, E
Services: M, A

Acme Die Casting Corp.
1635 Murrary Ave.
Racine, Wis.
Metals: A, B
Services: M, F, A

Acme Tool & Die Casting Co.
4250 E. Washington Blvd.
Los Angeles 23, Calif.
Metals: A, B, C, E
Services: M, F, A

Action-Hopkins Machine & Foundry Co.
2615 Second Ave., N.
Birmingham 3, Ala.
Metals: A, B, C, D, E
Services: M, F, A

Adco Die Cast Co., Inc.
9555 Rush St.
El Monte, Calif.
Metals: A, C, D
Services: M, F, A

Adept Castings, Inc.
S. Henrietta St.
Hicksville, N.Y.
Metals: A, B
Services: M, F, A

Adjel Products Co.
13561 Helen Ave.
Detroit 12, Mich.
Metals: B
Services: M, F, A

**Advance Pressure Casting Corp.* **
276 State Highway #53
Denville, N.J.
Metals: A, B
Services: M, F, A**

**Advance Tool & Die Casting Co.* **
3760 N. Holten St.
Milwaukee 12, Wis.
Metals: A, B
Services: M, F, A**

Ajax Die Casting & Mfg. Co.
2002 E. 6th St.
Tulsa, Okla.
Metals: A, B, E
Services: M, F, A

Akron Presform Mold Co.
2038 Main St.
Cuyahoga Falls, Ohio
Metals: A, B
Services: M, F, A

Alacast Corp.
2229 Fourth St.
Berkeley, Calif.
Metals: A, C, D, E, F
Services: M, F, A

Albany Chicago Co.
3253 S. Normal
Chicago 16, Ill.
Metals: B
Services: M, F, A

Allen-Stevens Corp.* **
62 St. & 34 Ave.
Woodside 77, N.Y.
Metals: B
Services: M, F, A

Alliance Tool & Die Casting Corp.
2932 Burleigh
Milwaukee 10, Wis.
Metals: B
Services: M, A

Allied Die Cast Corp.
7080 N.W. 37 Ct.
Miami, Fla.
Metals: A, B
Services: M, F, A

Allied Machine & Engineering Co.
401 So. Delaney Rd.
Owosso, Mich.
Metals: A, C
Services: M, F, A

**Alloy Die Casting Co.*
2211 Firestone Blvd.
Los Angeles 2, Calif.
Metals: A, B
Services: M, F, A**

Alpha Industries Die Casting Div.
1300 Wheatland Ave.
Logansport, Ind.
Metals: A, B
Services: M, A

Alpine Engrg. & Mfg. Co.
4901 W. 58th Ave.
Arvada, Colorado
Metals: B
Services: M, F, A

Alumiloy Fabricators, Inc.
202 W. Bennett St.
Saline, Mich.
Metals: A
Services: M, F, A

Aluminum Co. of America*
Edison, N.J.
Metals: A, C
Services: M, F, A

Aluminum Co. of America
Pittsburgh 19, Pa.
Metals: A, C
Services: M, F, A

Aluminum Die Casting Co.*
3452 San Fernando Rd.
Los Angeles 65, Calif.
Metals: A
Services: M, F, A

Aluminum Die Cast Fonudries, Inc.
Redkey, Indiana
Metals: A, B
Services: M, F, A

Ambrit Industries* **
1288 Los Angeles St.
Glendale 4, Calif.
Metals: A, B, E
Services: M, A

American Aluminum Casting Co.*
324 Coit St.
Irvington 11, N.J.
Metals: A
Services: M

American Die Casting Co.
850 Pannell St., N.W.
Grand Rapids 4, Mich.
Metals: B
Services: M, F, A

Amerock Corp.
4000 Auburn St.
Rockford, Ill.
Metals: B
Services: M, F, A

Amplex Engineering Co.
P.O. Box 109
New Castle, Ind.
Metals: E
Services: F

Anderson Die Casting Co.* **
1000 E. 60th St.
Los Angeles 1, Calif.
Metals: A, B, C, D
Services: M, F, A

Joe Anderson Die Casting Co.
2600 S. Delaware
Denver 23, Colo.
Metals: B
Services: M, A

For a description of the symbols refer to page 71.

Anderson Tool & Mfg. Co.
3450 N. Kostner Ave.
Chicago 41, Ill.
Metals: A, B
Services: M, A

Apex Die Cast Co.
2375 E. 8 Mile Rd.
Warren, Mich.
Metals: B
Services: M, F, A

Apex Die Casting Co.
P.O. Box 8
Troy, Ohio
Metals: A

Argo Die Casting, Inc.
106 Powerhouse Rd.
Roslyn Hts., L.I., N.Y.
Metals: B, E
Services: M, F

Arkansas Die Casting Co.
Box 26
Harrison, Ark.
Metals: A, B
Services: M, F

Arlington Industries, Inc.
2 Dockash Pl.
Scranton 3, Pa.
Metals: B
Services: M, F, A

Arro Expansion Bolt Co.
P.O. Box 388
Marion, Ohio
Metals: B, E
Services: M, F, A

Arrow-Acme Corp.
Box 218
Webster City, Iowa
Metals: A, B
Services: M, F, A

Arrow Aluminum Castings Co.
3135 Berea Rd.
Cleveland 11, Ohio
Metals: A
Services: M, F

Arrow Die Casting Co.
4031 Goodwin Ave.
Los Angeles 39, Calif.
Metals: A, B
Services: M, A

Art Jack Die Casters, Inc.
196 Murray St.
Newark 5, N.J.
Metals: B
Services: M, F

Atlantic Die Casting
2585 Beaufait
Detroit 7, Mich.
Metals: A
Services: M, F, A

Atlas Die Casting Co.* **
362 N. Kelly Ave.
Germantown, Ohio
Metals: A, B
Services: M, A

Atherton Tool, Die & Mold Co.
1614 S. Sycamore St.
Santa Ana, Calif.
Metals: A, B, C, D
Services: M, F, A

Atomic Die Casting Corp.
7817 S. Claremont Ave.
Chicago 20, Ill.
Metals: A, B
Services: M, F

Auburn Diecast Corp.
1632 W. Midland Rd.
Auburn, Mich.
Metals: A, C
Services: M, F, A

Auel Industries
Herminie, Pa.
Metals: B
Services: M, F, A

Aurora Metal Co.
614 W. Park Ave.
Aurora, Ill.
Metals: D
Services: M

Austin Die Casting Co.
16837 S. Broadway
Gardena, Calif.
Metals: B
Services: M, F, A

Automotive Accessory Co., Ltd.
1551 Erin St.
Winnipeg, Manitoba, Can.
Metals: B
Services: M, F, A

Badger Die Casting Corp.* **
201 W. Oklahoma Ave.
Milwaukee, Wisc.
Metals: A, B
Services: M, A

Banthrico Industries, Inc.
17 N. Desplaines St.
Chicago 6, Ill.
Metals: B
Services: M, F, A

Barber Die Casting Co., Ltd.
Box 416 Postal Stn. "B"
Hamilton, Ont., Canada
Metals: A, B, C, D
Services: M, F, A

Ralph Barnes Moulded Plastics
18903 S. Figueroa
Gardena, Calif.
Metals: A
Services: M, F, A

Basic Aluminum Castings Co.
1325 E. 168th St.
Cleveland 10, Ohio
Metals: A
Services: M, F, A

Bassick-Sack Div.
Stewart-Warner Corp.
P.O. Box 4237
Winston-Salem, N.C.
Metals: B
Services: M, F, A

Beaut Mfg. Co.
7500 Tonnelle Ave.
North Bergen, N.J.
Metals: B, E
Services: M, F, A

Belden Mfg. Co.
Richmond, Ind.
Metals: E
Services: A

Benda Tool & Model Works
1444 4th St.
Berkeley 10, Calif.
Metals: A, B, D, E, F
Services: M, F, A

C. & W. Metal Finishing, Inc.
3525 S. Greenwood Ave.
Los Angeles 22, Calif.
Metals: B
Services: F

Benton Harbor Malleable Industries Inc.
171 Graham Ave.
Benton Harbor, Mich.
Metals: A, B
Services: M, F, A

Binkley Die Casting Co., Ltd.
175 Samuelson St.
Galt, Ont., Canada
Metals: B
Services: M, A

Blue Ridge Pressure Casting, Inc.*
Bridge St.
Lehighton, Pa.
Metals: A, B, D
Services: M, A

Bowersox Precision Castings Co.
3523 W. 9th St.
Chester, Pa.
Metals: A, B
Services: M, F, A

Brillcast, Inc.
2544 Thornwood S.W.
Grand Rapids 9, Mich.
Metals: A, B
Services: M, F, A

Bruce Mfg. & Molding Co., Inc.
Atwater St.
Plantsville, Conn.
Metals: A, B
Services: M, F, A

Bruin Mfg. Co.
P.O. Box 121
Marshalltown, Iowa
Metals: A, B
Services: M, F, A

Bucy Diecasting
625 S. Glenwood Pl.
Burbank, Calif.
Metals: A, B, C, D

Buehrle Engineering Co.
856 E. Broadway
Muskegon, Mich.
Metals: A, B
Services: M, A

Burton Die Casting Co.
6427 Davison Rd.
Davison, Mich.
Metals: B
Services: M, A

Cal Alloy Castings, Inc.
774 Monterey Pass Rd.
Monterey Park, Calif.
Metals: B
Services: M, F, A

Caldwell Casting Co., Inc.
Market St.
Cambridge, Md.
Metals: A, B
Services: M, F, A

Calko Die Casting Co.
43 Sunnyside Ave.
Stamford, Conn.
Metals: B, E, F
Services: M, F, A

Callen Mfg. Corp.* **
1425 N. 1st Ave.
Maywood, Ill.
Metals: A, B
Services: M, F, A

Camp Aircraft Parts
1133-39 McCarter Hwy.
Newark 2, N.J.
Metals: A, B
Services: M, A

John J. Carey Co.
2194-96 Bridge St.
Philadelphia 24, Pa.
Metals: B
Services: M, F, A

Carolina Foundry Co.
Box 635
Charlotte, N.C.
Metals: A
Services: M, F

Carpenter Die Casting Co., Ltd.
474 Burlington E.
Hamilton, Ont., Can.
Metals: A, B, E, F
Services: M, F, A

Casper's Machine Shop
1047 77th Ave.
Oakland 21, Calif.
Metals: A, B, D
Services: M, F, A

Cast-O-Matic Corp.* **
P.O. Box 1172
Syracuse 1, N.Y.
Metals: A, B
Services: M, A

Central Die Casting & Mfg. Co.* **
2937 W. 47th St.
Chicago 32, Ill.
Metals: A, B
Services: M, F, A

Centr-O-Cast & Engineering
45 St. Jean St.
Detroit 14, Mich.
Metals: A
Services: F

Century Die Casting Co.*
2629 Fletcher St.
Chicago 18, Ill.
Metals: A, B
Services: M, F

W. L. Chapman Co., Inc.*
2886 E. Walnut St.
Pasadena 8, Calif.
Metals: A, C, D
Services: F

Char-Lynn Co.*
2843 26th Ave. S.
Minneapolis 6, Minn.
Metals: A
Services: M, F, A

Chautauqua Hardware Corp.
31 Water St.
Jamestown, N.Y.
Metals: A, B, E, F
Services: M, F, A

Chicago Die Casting Mfg. Co.
2514 W. Monroe St.
Chicago 12, Ill.
Metals: B, E
Services: M, F, A

Chicago Expansion Bolt Co.
1338 W. Concord Pl.
Chicago 22, Ill.
Metals: E

Chicago White Metal Casting, Inc.* **
5239 W. Grand Ave.
Chicago 39, Ill.
Metals: A, B
Services: M, F

For a description of the symbols refer to page 71.

Circle No. 76 on Reader Service Card

SAVE 70% with MASTER-MOLD

MASTER-MOLD WORKS FOR YOU to bring overhead and operating costs down to a realistic level. **MASTER-MOLD** can save you up to 70% because this new technique eliminates expensive die sets and other costly equipment — slashes set-up time, labor costs . . . **handles two jobs at once.**

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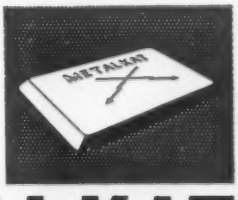

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Circle No. 46 on Reader Service Card

Cincinnati Die Casting Co.* **
2117 Spring Grove
Cincinnati 14, Ohio
Metals: A, B
Services: M, F, A

Clinton Engines Corp.
Clinton, Mich.
Metals: A, B, C
Services: M, F, A

Coast Die Casting Co.
5752 Joanne Pl.
Culver City, Calif.
Metals: A, B
Services: M, F, A

Comet Metal Products Co., Inc.
91-05 132 St.
Richmond Hill 18, N.Y.
Metals: B, E, F
Services: M, F, A

Conetta Tool & Die Co.
73 Sunnyside Ave.
Stamford, Conn.
Metals: B
Services: M, F, A

Conneaut Die Casting Co.* **
618 Sandusky St.
Conneaut, Ohio
Metals: A, B
Service: M, F, A

Consolidated Die Cast Corp. of America
P.O. Box 330
Dowagiac, Mich.
Metals: A, B
Services: M, F, A

Continental Die Casting Corp.
9615 Grinnell Ave.
Detroit 13, Mich.
Metals: B
Services: M, F, A

Continental Metallifacture Co.
414 Pine St.
Scranton, Pa.
Metals: A, B
Services: M, A

Cordray Die Casting Co.
6565 S. Wilson St.
Los Angeles 1, Calif.
Metals: B, E
Services: M, F, A

Cosmopolitan Die Cast Products
46 Etruria St.
Seattle 9, Wash.
Metals: B
Services: M, F, A

Coulter Mfg. Co., Ltd.
28 Richmond St. W. Box 190
Oshawa, Ont., Canada
Metals: B
Services: M, F, A

Crescent Co.
20 Central Ave.
Pawtucket, R.I.
Metals: E

Crown City Die Casting Co.
84 N. Fulton Ave.
Pasadena 8, Calif.
Metals: A, B
Services: M, A

Crown Novelty Works
85-15 Liberty Ave.
Ozone Park 17, N.Y.
Metals: B, E
Services: M, A

D & M Die Cast Co.
704 S. Janss St.
Anaheim, Calif.
Metals: A, B, C, D
Services: M, F, A

Dallas Die Casting Co.
334 Rock Island
Dallas 7, Texas
Metals: A, B
Services: M, F, A

Daniel Co., Edward W.
4050 St. Clair Ave.
Cleveland 3, Ohio
Metals: B
Services: M, F, A

Davis Products Corp.
601-39th St.
Brooklyn 32, N.Y.
Metals: B
Services: M, F, A

Dayton Die Casting Co.
111 Front St.
Dayton 2, Ohio
Metals: A, B, E
Services: M, F

Dearborn Die Casting & Cavity Co.
199 Vinewood
Detroit 16, Mich.
Metals: B
Services: M, F

Delta Die Casting Corp.*
9393 W. Seymour Ave.
Schiller Park, Ill.
Metals: A
Services: M, A

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Circle No. 61 on Reader Service Card

A. J. Demoude Co.
P.O. Box 392
Beaverton, Oreg.
Metals: B
Services: M, F, A

Deroy Mfg. Co.
9208 Atlantic Ave.
South Gate, Calif.
Metals: B
Services: M, F, A

Detroit Die Casting Corp.* **
597 Beaufait
Detroit, Mich.
Metals: B
Services: M, F, A

Dialoy Inc.
214 S. Clinton St.
Chicago 6, Ill.
Metals: A, B, D
Services: M, F

Di-Cast Mfg. Co.
15 Bradford Place
Brockton, Mass.
Metals: A, B, D
Services: M, F, A

Die Cast & Forge Corp.
190 Petersville Rd.
New Rochelle, N.Y.
Metals: B, E
Services: M, F, A

Diecast Corp.* **
522-24 Hupp Ave.
Jackson, Mich.
Metals: A, B
Services: M, F

Die Cast Mfg. Co.
10138½ E. Rush St.
El Monte, Calif.
Metals: A, B
Services: M, F, A

Die Cast Products, Inc.* **
621 W. Rosecrans Ave.
Gardena, Calif.
Metals: A, B
Services: M, A

Die Cast Products, Inc.
4040 Hough Ave.
Cleveland 3, Ohio
Metals: A, B, E
Services: M, F, A

Die Cast Products, Ltd.
1085 Winnipeg Ave.
Winnipeg 3, Manitoba, Canada
Metals: B
Services: M, F, A

Diecasters, Inc.
90 Herbert Ave.
Closter, N.J.
Metals: A, B, D
Services: M, A

Dieco Die Casting Co.
59-27 Decatur St.
Ridgewood 27, N.Y.
Metals: B
Services: M, F, A

Die Casting Corp. of Florida
3000 N.W. 75th St.
Miami 47, Fla.
Metals: A, B

Dietz Die Casting
2031 N. Seaman Ave.
S. El Monte, Calif.
Metals: A, B
Services: M, A

Di Salle Plating & Die Casting, Inc.
2851 S. Ave.
Toledo, Ohio
Metals: B
Services: M, F, A

Dixie Die Casting Co.
741 S. West End Ave.
Detroit 17, Mich.
Metals: B
Services: M, F, A

Dixie Die Casting Corp.
P.O. Box 1208
Reidsville, N.C.
Metals: A, B
Services: M, F

Doehler-Jarvis Div.* **
National Lead Co.
1945 Smead Ave.
Toledo 1, Ohio
Metals: A, B, C, D
Services: M, F, A

Dollin Corp.* **
600 S. 21st St.
Irvington 11, N.J.
Metals: A, B
Services: M, F, A

Dominion Die Casting, Ltd.
Libby St.
Wallaceburg, Ont., Canada
Metals: A, B
Services: M, A

For a description of the symbols refer to page 71.

Bobinchuck
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Circle No. 17 on Reader Service Card

Dominion Lock Co., Ltd.
7301 Decarie Blvd.
Montreal, Que., Can.
Metals: A, B
Services: M, F, A

Dormeyer Corp.
Mid-Western Die Casting Div.
1501 N. Halstead St.
Chicago 22, Ill.
Metals: A, B
Services: M, F

Douglas-Stemac, Inc.
620 12th Ave., S.
Minneapolis 4, Minn.
Metals: B
Services: M, F, A

Dow Metal Products Co.*
Hopkins Bldg.
Midland, Mich.
Metals: A, C
Services: M, F, A

Dowst Mfg. Co.
600 N. Pulaski Rd.
Chicago 24, Ill.
Metals: B
Services: M, F, A

Dryad Die Casting Co.
North Ave.
Manchester, N.Y.
Metals: A, B
Services: M, F, A

Dual Die Casting
625 S. Columbus Ave.
Mt. Vernon, N.Y.
Metals: B
Services: M, F, A

Duane Specialties Ltd.
2 Johnson St.
Newark 5, N.J.
Metals: B
Services: M, F, A

Dunbar Aluminum Foundry Ltd.
315 Breithaupt St.
Kitchener, Ont., Can.
Metals: A
Services: M, F, A

Du Page Diecasting & Fabricating Co.
8049 N. Ridgeway
Skokie, Ill.
Metals: A, B
Services: M, F, A

Dura Corp.
21800 Greenfield
Oak Park, Mich.
Metals: B
Services: M, F, A

Du-Rite Die Casting Corp.
239 Watchung Ave.
W. Orange, N.J.
Metals: B
Services: M, F, A

Duvall Mfg. Co.
Box 866
Chula Vista, Calif.
Metals: B
Services: M, F, A

Du-Wel Metal Products Co.* **
P.O. Box 307
Bangor, Mich.
Metals: B
Services: M, F, A

Dynamic Die Casting Co.
510 W. 10 Mile Rd.
Madison Hts., Mich.
Metals: B
Services: M, F

E. B. Metal Products Co., Inc.
Box 149
Whitehall, N.Y.
Metals: B
Services: F

Earl Electric Mfg. Corp.
35-20 Borden Ave.
Long Island City 1, N.Y.
Metals: B
Services: M, F

Eastern Casting Corp.
64 S. William St.
Newburgh, N.Y.
Metals: A
Services: M, F, A

Eastern Non-Ferrous Foundries, Inc.
2811 Amber St.
Philadelphia 34, Pa.
Metals: A, B

Robert H. Eggers Co.
4701 Perkins Ave.
Cleveland 3, Ohio
Metals: A
Services: M, F, A

Ehrhart Die Casting Co.
K. O. K. X. Road
Hamilton, Ill.
Metals: B
Services: M, F, A

Eklind Tool & Mfg. Co.
2627 N. Western Ave.
Chicago 47, Ill.
Metals: B
Services: M, F, A

El Cajon Die Cast & Mfg. Co.
590 Marshall St.
El Cajon, Calif.
Metals: B
Services: M, F, A

Electric Autolite Co., The
Champlain St.
Toledo, Ohio
Metals: A, B
Services: M, F, A

El Monte Tool & Die Cast, Inc.* **
2425 N. Tyler Ave.
El Monte, Calif.
Metals: A, B
Services: M, F

Empire Die Casting Co.
19800 Miles Ave.
Cleveland 28, Ohio
Metals: A, C
Services: M, F

Engineering Cast Products
17501 Swift Ave.
Detroit 3, Mich.
Metals: A, B, D
Services: F

Engineers Tool & Mfg. Co.
7 Islandbrook Ave.
Bridgeport 6, Conn.
Metals: B
Services: M

Ertl Co., Inc.
Hwy. 136
Dyersville, Iowa
Metals: A, B
Services: M, F, A

Esquire Novelty Corp.
151 West Side Ave.
Jersey City, N.J.
Metals: B
Services: A

Essex Die Cast Corp.
Three Rivers, Mich.
Metals: A, B
Services: M, F, A

Falconer Metal Specialties Co., Inc.* **
Winchester Rd.
Lakewood, N.Y.
Metals, A, B
Services: M, F, A

Fall River Tool & Die Co., Inc.
994 Jefferson St.
Fall River, Mass.
Metals: A, B
Services: M, A

Faultless Caster Corp.
1421 N. Garvin St.
Evansville 7, Ind.
Metals: B
Services: M, F, A

Federal Aluminum Foundry Co.
411 Williams St.
Camden, N.J.
Metals: B

Finkel Umbrella Frame Co., Inc.
2534 Bruckner Blvd.
New York 61, N.Y.
Metals: B
Services: M, F, A

Fisher Gauge Works Ltd.
Peterborough
Ontario, Canada
Metals: A, B, E, F
Services: M, A

Florida Fishing Tackle Mfg. Co., Inc.
2100 First Ave. S.
St. Petersburg, Fla.
Metals: A, D, E
Services: M, F, A

Food Machinery & Chemical Corp.
San Jose, Calif.
Metals: E

Form-A Die Casting Corp.
37 Whitcomb St.
Waltham 54, Mass.
Metals: A, B
Services: M, F

Forster-Appelt Mfg. Co., Inc.
82 E. Lanark Ave.
Lanark, Ill.
Metals: A, C, E
Services: M, F, A

Fort Recovery Industries, Inc.
Fort Recovery, Ohio
Metals: A, B
Services: M, F, A

Fort Worth Die Cast Co., Inc.
1213 E. Daggert
Fort Worth, Tex.
Metals: A, B, E, F
Services: M, F, A

Francis Co., A. W.
Box 266
Somerset, Pa.
Metals: B
Services: M, F, A

Frantz Mfg. Co.
1200 Camden Ave., S.W.
Canton 6, Ohio
Metals: A, B
Services: M, F, A

Future Products Co.* **
3625 N. Mississippi Ave.
Portland 17, Oreg.
Metals: A, B
Services: M, F, A

Gasket Packing & Specialty Co., Inc.
45 N. Saxon Ave.
Bay Shore, N.Y.
Metals: E, F
Services: M, F, A

Gemco Mfg. Co., Inc.
501 S. Lipan St.
Denver 23, Colo.
Metals: A, B, E, F
Services: M, F, A

General Cast Products, Inc.
2211 Waverly Ave.
Swissvale, Pa.
Metals: B
Services: M, F

General Die Cast Co.
10750 Capital
Oak Park 37, Mich.
Metals: B
Services: M, F, A

General Diecasters, Inc.
6212 Akron Peninsula Rd.
Peninsula, Ohio
Metals: B
Services: M, F, A

General Electric Co.
Magnetic Materials Sect.
Edmore, Mich.
Metals: A
Services: M

General Electric Co.
Erie Foundries
Erie, Pa.
Metals: D

General Electroplating Co.
621 E. Walnut St.
Indianapolis 4, Ind.
Metals: B
Services: M, F, A

General Metals Corp.
444 S. 9th Ave.
Mount Vernon, N.Y.
Metals: B
Services: M, F, A

General Motors Corp.
Brown-Lipe-Chapin Div.
Town Line Rd.
Syracuse, N.Y.
Metals: B
Services: F, A

General Motors Corp.
Central Foundry Div.
Fabricast Plant
P.O. Box 271
Bedford, Ind.
Metals: A, C
Services: F, A

General Motors Corp.
Central Foundry Div.
37 Florence St.
Saginaw, Mich.
Metals: A

General Motors Corp.
Delco Radio Div.
700 E. Firmin St.
Kokomo, Ind.
Metals: B
Services: M, F, A

General Motors Corp.
Guide Lamp Div.
P.O. Box 1090
Anderson, Ind.
Metals: B
Services: M, F, A

For a description of the symbols refer to page 71.

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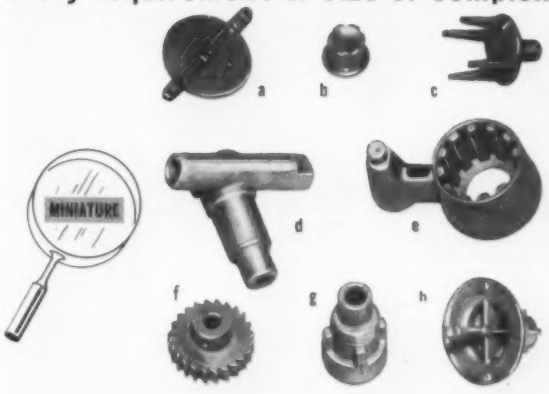
DELIVERY: The completeness of Paramount's facilities plus careful scheduling insures deliveries that fit your production plans.

... and ZINC AND ALUMINUM DIE CASTINGS to meet every requirement of size or complexity



a Aircraft Diaphragm Support.
b Hi-Fi Control Knob.
c Gasoline Pump Poppet Stem.
d Speed Control Indicator Housing.
e Wringer Washer Hose Hook.
f Washing Machine Ratchet Gear.
g Electrical Connector.
h Power Brake Poppet Valve.

LARGE

Transmission Extension Housing

Air Conditioner Control Panel

COMPLEX

Automotive Fuel Cover

Automatic Transmission Part

If your product incorporates die castings or you're considering them—investigate Paramount's complete service.

PARAMOUNT Die Casting Co.
(A subsidiary of TALON, INC.) ST. JOSEPH 5, MICHIGAN
Three complete plants—two in St. Joseph, Mich., one in Seymour, Ind.

Send for descriptive brochure and "Designing For Die Casting".

Circle No. 69 on Reader Service Card

Gibbs Automatic Molding* **
Div. Pierce Industries, Inc.
1105 5th St.
Henderson, Ky.
Metals: A, B
Services: M, F, A

Glendale Products
1002 Section Line
Malvern, Ark.
Metals: A, D
Services: M, F, A

Gorton Die Casting Co.
55 S. 3rd Ave.
Mt. Vernon, N.Y.
Metals: B
Services: F

Grand Die Casting, Inc.*
7936 W. Grand Ave.
Elmwood Park 35, Ill.
Metals: A, B
Services: M

Grand Rapids Brass Co.
Div. of Crampton Mfg. Co.
420 W. 50th St., S.W.
Grand Rapids 8, Mich.
Metals: B
Services: M, F, A

Grand Rapids Plating Co
1140 Monroe Ave.
Grand Rapids, Mich.
Metals: B
Services: M, F, A

Grand Steel & Mfg. Co.
1400 W. 14 Mile Rd.
Clawson, Mich.
Metals: A, B
Services: M, F, A

C. M. Grey Industries, Inc.* **
358 Central Ave.
E. Orange, N.J.
Metals: A, B, E, F
Services: M, F, A

**Gries Reproducer Corp.* **
125 Beechwood Ave.
New Rochelle, N.Y.
Metals: B
Services: M, A**

Gyle Engineering Co.
6519 Wilson Ave.
Los Angeles 1, Calif.
Metals: A, B, C
Services: M, F, A

**H & S Metal Products Co.
4159 Whiteside St.
Los Angeles 63, Calif.
Metals: A, C
Services: M, F, A**

Hadlock & Temte, Inc.
3336 W. Franklin Blvd.
Chicago 24, Ill.
Metals: B
Services: M, F, A

Halex Die Casting Co.
8640 Bessemer Ave.
Cleveland 4, Ohio
Metals: A, B
Services: M, F, A

C. M. Hall Lamp Co.
1035 E. Hancock Ave.
Detroit 7, Mich.
Metals: B
Services: M, F, A

Joseph Hall Co.
2121 W. Clearfield St.
Philadelphia, Pa.
Metals: B
Services: M, F, A

Hall Level Mfg. Works
1119 E. 4th St.
Austin, Tex.
Metals: B, E
Services: M, F, A

Hamilton Die Cast Co.
240 N. "B" St.
Hamilton, Ohio
Metals: A, B
Services: M, F, A

Hamilton Die Casting Corp.*
2020 Jericho Turnpike
New Hyde Park, N.Y.
Metals: A, B
Services: M, A

Hamilton Machine Shop
7829 Hamilton Ave.
Pittsburgh 21, Pa.
Metals: B
Services: M, F, A

Hamlin Products, Inc.
P.O. Box 3703
Little Rock, Ark.
Metals: A
Services: M, F, A

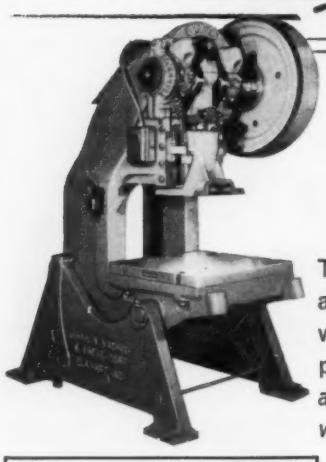
Hammond Die Casting Co.
308 N. Leroy
Fenton, Mich.
Metals: B
Services: M, F, A

**Hampden Brass & Aluminum Co.
262 Liberty St.
Springfield, Mass.
Metals: A, B
Service: M, F**

Harbot Die Casting Corp.*
52 E. Centre St.
Nutley, N.J.
Metals: A
Services: M, F

Hardy Manufacturing Corp.
Union City, Ind.
Metals: B
Services: M, F, A

FOR HIGH SPEED NEEDS
on a low tonnage press



CHOOSE
JOHNSON!

MODEL 27W (27 TON)
MODEL 45W (45 TON)
MODEL 60W (60 TON)

These three presses are especially adapted for handling large light-weight sheets and for notching or piercing off-center operations. *And at slower speeds they perform equally well for die cast trimming.*

Special features of these models

- Extra Wide Beds
- Extra Deep Throats
- Extra Large Ram Faces
- Extra Shut Heights
- Extra Large Openings through Backs
- Pin Clutch or Air Clutch
- Flywheel or Back Geared

Write for your copy of our complete 8 page catalog which covers the complete line in easy-to-read chart form.

Johnson
POWER PRESSES

Johnson Machine & Press Corp., Division Bontrager Corp.
624 West Indiana Ave., Elkhart, Indiana

Circle No. 49 on Reader Service Card

Harrelson Mfg. Co.
Calhoun City, Miss.
Metals: B, E
Services: M, F, A

Hartzell Mfg., Inc.* **
2516 Wabash Ave.
St. Paul 14, Minn.
Metals: A, B
Services: M, F, A

**Harvill Corp.* **
6521 W. Century Blvd.
Los Angeles 45, Calif.
Metals: A, B, C, D
Services: M, F, A**

H. L. Harvill Mfg. Co.
P.O. Box 777
Corona, Calif.
Metals: A, B, C, D
Services: M, F, A

Haug Die Casting Corp.* **
356 W. 1st Ave.
Roselle, N.J.
Metals: B
Services: M, F, A

Hayden Mfg. Co.
618 Hartrey Ave.
Evanston, Ill.
Metals: B
Services: M, F, A

Heick Die Casting Corp.* **
6550 W. Diversey Ave.
Chicago 35, Ill.
Metals: A, B
Services: M, F, A

Helfrich Die Casting Co.
207 Schneider Rd.
North Canton, Ohio
Metals: B
Services: M

Helm Accessories, Inc.
9818 Grinnell St.
Detroit 13, Mich.
Metals: A, B
Services: M, F, A

Herlicon Metals & Plastics, Inc.
3815 Ruskin St.
Montreal, Que., Can.
Metals: A, B
Services: M, F, A

Hermel Die Casting Corp.
Love Rd.—P.O. Box 155
Eau Claire, Mich.
Metals: A, B
Services: M, A

Hilfinger Corp.* **
1800 Westwood Ave.
Toledo 7, Ohio
Metals: B
Services: M, F, A

Holland Die Casting & Plating Co.
582 E. Lakewood Blvd.
Holland, Mich.
Metals: B
Services: M, F, A

Holmco, Inc.
Holmes, Iowa
Metals: A
Services: M, F, A

Home Plating Co.
9177 Mass Ave.
Indianapolis, Ind.
Metals: B
Services: M, F, A

Hooper Die Casting Co.
623 Prospect St.
Trenton 8, N.J.
Metals: B, E

Hoover Ball & Bearing Co.
Glenvale Products Div.
Malvern, Ark.
Metals: A, D
Services: M, A

Hoover Ball & Bearing Co.
Universal Die Cast Div.
Bennett St.
Saline, Mich.
Metals: B
Services: M, F, A

**Hoover Co., Ltd., The
Gage Ave. N.
Hamilton, Ont., Canada
Metals: A
Services: M, F, A**

**Hooevr Co., The* **
Die Cast Div.
North Canton, Ohio
Metals: A, B
Services: M, F, A**

Hubley Manufacturing
Box 240
Lancaster, Pa.
Metals: B
Services: M, F, A

R. W. Hughes Industries, Inc.
2713 Ludelle St.
Fort Worth, Tex.
Metals: A
Services: M, F, A

For a description of the symbols refer to page 71.

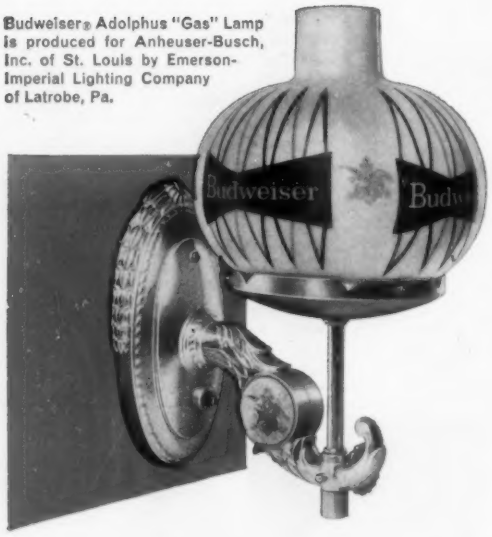
BADGER
DIE CASTING

WILL GIVE YOU THE CORRECT ANALYSIS OF THE ECONOMIES TO BE OBTAINED FROM DIE CASTING IN ZINC OR ALUMINUM IN ANY QUANTITY.

BADGER DIE CASTING CORP. 201 W. Oklahoma Ave. Milwaukee 7, Wis.

Circle No. 15 on Reader Service Card

Budweiser® Adolphus "Gas" Lamp is produced for Anheuser-Busch, Inc. of St. Louis by Emerson-Imperial Lighting Company of Latrobe, Pa.



L. D. C. ZINC ALLOY DIE CASTINGS

add a bright new light to an effective sales technique

Here's point-of-sale advertising at its best—commandeering attention and holding its enviable and permanent position in the center of a highly competitive consumer market—creating impulses that roll into steady sales—continuously!

Yes, Budweiser® Adolphus "Gas" Lamps by Anheuser-Busch, Inc., do just that—doubly so, because they're installed in pairs, flanking the ends of thousands of backbars across the country.

So you order a "Bud"®, and your eyes dance over the quaint old-fashioned design of the Lamp's base, as you wait to be served. How sharp the minute details of the design in the base appear—and are! The smooth, even fit of the parts . . . the soft, golden finish that glistens so bright . . .

Now you know! That elegant, ornate base is L. D. C. Zinc Alloy Die Casting! It has captured and preserved all the warmth and friendliness of a Century passed through modern design techniques and color treatment that only quality workmanship through quality materials can produce.

L. D. C. Zinc Alloy Die Castings electroplate easily and retain a high gloss polished finish.

Dimensional stability and strength of L. D. C. Zinc Alloy Die Cast shells assure neat, accurate fit, and a smooth, even finish that sharpens design details.

Latrobe Die Casting Co.
LATROBE, PENNSYLVANIA

DISTRICT OFFICES:

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E. G. Siess, Jr.
227 W. Exchange St.
Tel: Portage 2-7663

CLEVELAND, OHIO
William Kranz
20001 West Lake Road
Tel: Edison 1-6888

DETROIT, MICHIGAN
J. R. Lemen, Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thomson
741 Glenbrook Rd.
Glenbrook Station
Stamford, Conn.
Tel: Fireside 8-3985

BUFFALO, N. Y.
Harry W. Harding
235 Burke Drive
Tel: Amhurst 1164

DAYTON, OHIO
J. M. Gallaher
363 West First St.
Tel: Baldwin 4-3523

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Established 1918

Circle No. 53 on Reader Service Card

Hurd Lock & Mfg. Co.
9689 Grand River Ave.
Detroit 4, Mich.
Metals: B
Services: M, F, A

Hyatt Die Casting & Engineering Co.*
240 California St.
El Segundo, Calif.
Metals: A, B, C
Services: M, F

Hydro Die Casting Corp.
Sharon Ave.
Plattsburg, N.Y.
Metals: B
Services: M, A

Illinois Advance Die & Mold Co.
2005 N. Major Ave.
Chicago 39, Ill.
Metals: A, B
Services: M

Illinois Lock Co.
800 S. Ada St.
Chicago 7, Ill.
Metals: B
Services: M, F, A

Imperial Die Casting Corp.
11421 Knightsbridge Ave.
Culver City, Calif.
Metals: A, B
Services: M, F, A

Indiana Steel Products Co.
Valparaiso, Ind.
Metals: A
Services: M, F, A

Industrial Castings, Inc.
125 Willis St.
Bedford, Ohio
Metals: B

International Hardware Mfg. Co.
21641 Meyers Rd.
Detroit 37, Mich.
Metals: B
Services: M, F, A

Interstate Engineering Corp.
522 E. Vermont Ave.
Anaheim, Calif.
Metals: A, B
Services: M, F, A

Irrigation Equipment Co., Inc.* **
Industrial Div.
1300 Bethel Dr.
Eugene, Oreg.
Metals: A
Services: M, F, A

J & F Tool & Die Casting Corp.
R. D. #2
P. O. Box 175
Athens, Pa.
Metals: B
Services: M, F, A

Jersey Plastic & Die Casting Co.* **
149-165 Shaw Ave.
Irvington 11, N.J.
Metals: A, B
Services: M, F, A

Jervis Corp.
Grandville, Mich.
Metals: A, B
Services: M, F, A

Jet Die Casting Corp.* **
1317 W. Concord Pl.
Chicago 22, Ill.
Metals: A, B
Services: M

Joyner Silver & Electro- Plating Co.
Osseo, Minn.
Metals: B
Services: M, F, A

Kadee Metal Products Co.
720 S. Grape St.
Medford, Oreg.
Metals: A, B
Services: M, F, A

Kal-Die Casting Corp.
P. O. Box 2064
Kalamazoo, Mich.
Metals: A, B
Services: M, F

Kaljer Mfg. Co.
Middleville, Mich.
Metals: A
Services: M, F, A

Kamin Die Casting & Mfg. Co.*
3315 N. Knox Ave.
Chicago 41, Ill.
Metals: A, B
Services: M

Kasson Die & Motor Co.
34-08 Northern Blvd.
Long Island City 1, N.Y.
Metals: B
Services: M, F, A

Keeler Brass Co.
955 Godfrey Ave., S.W.
Grand Rapids, Mich.
Metals: A, B
Services: M, F, A

Ken-Moore Die Casting Co.
12299 Woodbine
Detroit 39, Mich.
Metals: B
Services: M, F, A

Kennedy Die Castings, Inc.
200 Harding St.
Worcester 1, Mass.
Metals: A, B
Services: M, A

Mark Kenny Products Co., Inc.
253 E. 137th St.
New York, N.Y.
Metals: B
Services: M, F, A

Kent Casting Corp.
200 Garden St., S.E.
Grand Rapids 7, Mich.
Metals: B
Services: M, F, A

King-Seeley Div.
King Seeley Corp.
1st St.
Ann Arbor, Mich.
Metals: B, F
Services: M, F, A

Kiowa Corp.* **
612 S. 12th St.
Marshalltown, Iowa
Metals: A, B
Services: M, F, A

Kiser Plating & Mfg. Co., Inc.
401 E. Howard St.
Muncie, Ind.
Metals: B
Services: M, F, A

Kisiel Die Casting Works
127 Otis St.
Batavia, N.Y.
Metals: A, B
Services: M, F, A

Kitchen-Quip, Inc.
E. Marion St.
Waterloo, Ind.
Metals: A
Services: M, F, A

Kohler Corp.
P. O. Box 104, Station B
Cincinnati 22, Ohio
Metals: A, B, C, D, E, F
Services: M, F, A

Kolsters Tool & Die Co.
8451 Baldwin St.
Oakland, Calif.
Metals: A, B, C
Services: M, F, A

Paul Krone Die Casting Co.* **
1811 N. Kostner Ave.
Chicago 39, Ill.
Metals: A, B
Services: M

Kuhlman Die Casting Co.
7300 E. 17th St.
Kansas City 3, Mo.
Metals: A, B
Services: M, F, A

Laco Die Casting Co.
23440 Lakeland Blvd.
Euclid 23, Ohio
Metals: B
Services: M, F, A

La France Precision Casting Co.
29th & McKean St.
Philadelphia, Pa.
Metals: B
Services: M, F, A

Lake Center Switch Co.
51 Johnson St.
Winona, Minn.
Metals: B
Services: M, F, A

Lake Erie Industries, Inc.
26420 Lakeland Blvd.
Euclid 32, Ohio
Metals: A, B
Services: M, F, A

Lakeshore Die Casting Co., Ltd.
482 Queen Elizabeth Way, E.
Oakville, Ont., Canada
Metals: A, B
Services: M, F, A

Lansco Die Casting Co.* **
2029 N. Chico Ave.
El Monte, Calif.
Metals: A, B
Services: M, A

Latrobe Die Casting Co.*
North & Unity Sts.
Latrobe, Pa.
Metals: A, B, E, F
Services: M

Lee Silver Service, Inc.
13451 Helen St.
Detroit 12, Mich.
Metals: B
Services: M, F, A

Lester Castings, Inc.*
25661 Cannon Rd
Bedford Hts., Ohio
Metals: A
Services: M, F, A

Lewis & Son, Inc.
Delaware Rd.
Marysville, Ohio
Metals: B
Services: M, A

For a description of the symbols refer to page 71.

Lincoln Die Casting, Inc.
15085 E. Eleven Mile
Roseville, Mich.
Metals: B
Services: M

Lincoln Industries, Inc.
4701 West Grand Ave.
Chicago 39, Ill.
Metals: A, B
Services: M, A

Line Tool & Machine Co.
21225 Van Dyke
Baseline, Mich.
Metals: A, B
Services: M, F, A

Litemetal Dicast, Inc.*
1927 Wildwood Ave.
Jackson, Mich.
Metals: A, B, C
Services: M, F

Logan Industries
1640 W. Carroll Ave.
Chicago, Ill.
Metals: B
Services: M, A

Long Island Die Casting, Inc.
21 Smith St.
Inwood, L.I. 96, N.Y.
Metals: B
Services: M, A

Los Angeles Die Casting Co.* **
340-346 Crocker St.
Los Angeles 13, Calif.
Metals: A, B, D
Services: M, F

Lukens Aluminum Co.
746 Albany St.
Dayton 8, Ohio
Metals: A, C, E, F
Services: M, F, A

Luster Corp.
Cleveland Rd.
Huron, Ohio
Metals: B
Services: M, F, A

Lyons Die Casting Co.
Buckner, Mo.
Metals: B
Services: M, A

**Madison-Kipp Corp.* **
213 Waubesa St.
Madison 4, Wis.
Metals: A, B
Services: M, A**

Madwed Mfg. Co.
261 River St.
Bridgeport 4, Conn.
Metals: B
Services: M, F, A

Magnesium, Inc.
1313 Kalamazoo St.
South Haven, Mich.
Metals: A, B, C, D

Major Controls Co.
13985 E. 6th St.
Corona, Calif.
Metals: A
Services: M, F, A

Manger Die Casting Co., Inc.
198 Seymour Ave.
Derby, Conn.
Metals: B
Services: M, F, A

Manor Die Cast Corp.*
P. O. Box 386
Bedford, Ohio
Metals: A
Services: M, F, A

Jos. P. Manz Die Casting Co.*
550 West Beach Ave.
Inglewood, Calif.
Metals: A
Services: M, F, A

L. E. Mason Co.*
98 Business St.
Boston 36, Mass.
Metals: A, B
Services: M, F, A

Mendler Mfg. Co.
Malden Rd.
Sandwich Postal Sta.
Windsor, Ont., Can.
Metals: B
Services: M, F, A

Metal-Cast Co.
616-16th Ave. West
Birmingham 4, Ala.
Metals: A, B
Services: M, A

Metalmasters, Inc.*
5725 N. Ravenswood Ave.
Chicago 26, Ill.
Metals: A, B
Services: M, F, A

Meta-Mold Aluminum Co.*
525 E. Hamilton Rd.
Cedarburg, Wis.
Metals: A, C

Metro Casting Co., Inc.
40 Laurel Dr.
Scranton 5, Pa.
Metals: B
Services: M, F, A

Micro Products Engineering Co.
234-40 Ridgewood Ave.
Newark 8, N.J.
Metals: B
Services: M, F, A

Middleville Engineering & Mfg. Co.
33 State St.
Middleville, Mich.
Metals: A, B
Services: M, F, A

Mid-State Die Casting Co.
7878 S. Division Ave.
Grand Rapids 8, Mich.
Metals: B
Services: M, F, A

Midwest Die Casting Co.* **
3930 N. First St.
Milwaukee 12, Wis.
Metals: B

Miller-Yoelin Co.
1925 N. Mendell St.
Chicago 22, Ill.
Metals: B

**Milwaukee Die Casting Co.* **
4132 N. Holton St.
Milwaukee 12, Wis.
Metals: A, B, E, F
Services: M, A**

Missouri Diecasting Div.
Pierce Industries, Inc.
1411 No. 17th St.
St. Louis 6, Mo.
Metals: A, B
Services: M, F

Model Die Casting, Inc.
3811 W. Rosecrans
Hawthorne, Calif.
Metals: A, B
Services: M, F, A

Modern Auto Accessories, Inc.
1328 W. Pico Blvd.
Los Angeles 15, Calif.
Metals: B
Services: M, F, A

Modern Die Casting Corp.*
5419 N. Kedzie Ave.
Chicago 25, Ill.
Metals: A, B
Services: M, A

Mohawk Foundry, Inc.
55 First St.
Berea, Ohio
Metals: A
Services: M, F, A

Molnar Molds & Molding
1358 Reservoir St.
Pomona, Calif.
Metals: A, B
Services: M

Monarch Aluminum Mfg. Co.* **
9205 Detroit Ave.
Cleveland 2, Ohio
Metals: A, B
Services: M, F, A

Monarch Die Casting Corp.
1642 20th St.
Santa Monica, Calif.
Metals: A, B
Services: M, F, A

Monarch Governor Co.
2800 Tyler Rd.
Willow Run, Mich.
Metals: A, B
Services: M, F, A

Monroe City Die Casting Co.
135 Front St.
Monroe City, Mo.
Metals: A, B
Services: M, A

Morton Mfg. Co., Inc.
7025 Sarpy Ave.
Omaha 47, Nebr.
Metals: A, B
Services: M, F, A

**Mt. Vernon Die Casting Corp.* **
Southfield Ave.
Stamford, Conn.
Metals: A, B
Services: M, F, A**

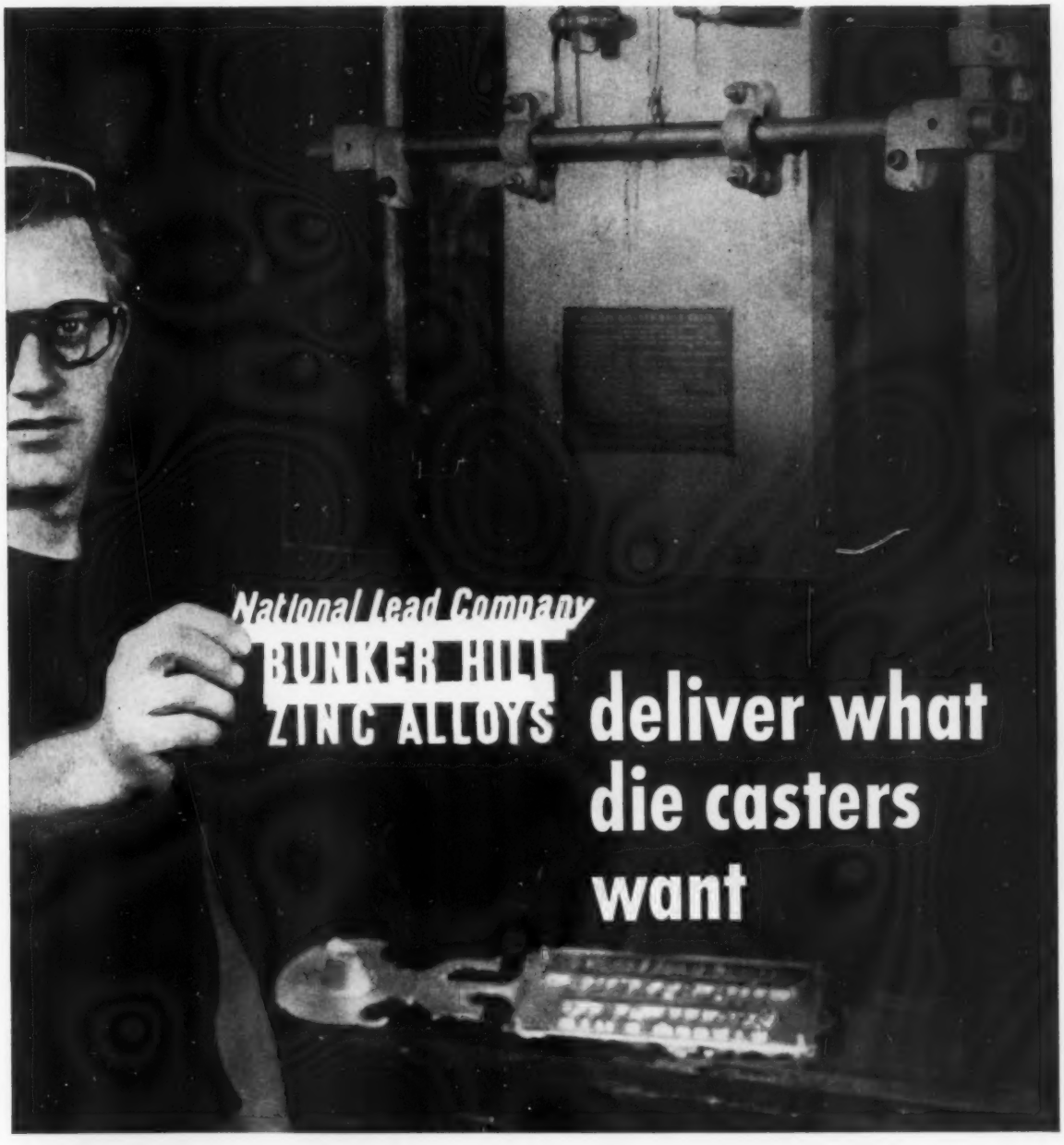
A. B. Mueller Co.
2101 E. John St.
St. Louis 7, Mo.
Metals: A, B
Services: M, F, A

Mutual Plating & Die Casting Co.
25611 W. 8 Mile Rd.
Detroit 40, Mich.
Metals: B
Services: M, F, A

Name Products, Inc.
Div. Grover Smith Mfg. Corp.
852 E. Valley Blvd.
San Gabriel, Calif.
Metals: B
Services: M, F, A

National Casting Corp.
6517 14th Ave.
Brooklyn, N.Y.
Metals: B
Services: M, F

For a description of the symbols refer to page 71.



Whatever you want in zinc alloys you get in *National Lead* Bunker Hill Zinc Alloys.

They're exceptionally pure. In fact, they more than meet ASTM and SAE specifications for freedom from contaminants.

You can count on *National Lead* Bunker Hill Zinc Alloys to give you sound, high-strength, porosity-free castings that require very little machining. What's more, they trim, punch, tap and broach cleanly . . . plate with little or no preparation . . . help you maintain fast, continuous production on all machines . . . and cut rejects to the bone.

Remember, the fastest forming process — from metal pig to manufactured part — is at its best only with the finest alloys. *And those are National Lead Company* Bunker Hill Zinc Alloys. When you need them — call us.

National Lead Company

General Offices: 111 Broadway
New York 6, N. Y.

Offices in principal cities

Dutch Boy PRODUCTS

Circle No. 65 on Reader Service Card

No parts* failures in 5 years— reports U. S. Electrical Motors Inc. to Asco Sintering Corporation

And the part to which they referred was the lock nut* on the main drive of the U. S. Varidrive Motor. This lock nut is manufactured for U. S. Motors by Asco Sintering Corporation of Los Angeles.

For 5 years, Bob Bowen, Asco's Production Manager, has relied on Hoeganaes MH-100 Iron Powder to give him trouble-free production. Mr. Bowen sums up the performance of Hoeganaes Sponge Iron Powders this way:

- *Good dimensional control.*
- *Good green and sintered strength.*
- *Uniformity from batch to batch.*
- *Good machinability.*

Your nearby Hoeganaes Service Engineer can acquaint you in more detail with the trouble-free performance factors that go hand-in-hand with Hoeganaes Powders. He's nearby and at your service.

Cross section view of U. S. Electrical Motor's Varidrive model. Arrow indicates lock nut manufactured by Asco Sintering Corporation, 7799 Telegraph Rd., Los Angeles, Calif.

HSIC

HOEGANAES SPONGE IRON CORPORATION

RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Montreal (Canada), Toronto (Canada), Los Angeles, Mexico 16, D. F. (Mexico), Minneapolis, New England (Elmira, N. Y.), Odessa (Texas), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

Circle No. 41 on Reader Service Card

National Die Casting Co.
3635 W. Toughy Ave.
Chicago 45, Ill.
Metals: A, B, D
Services: M, F, A

National Hardware Specialties, Ltd.
Dresden, Ont., Canada
Metals: B
Services: M, F, A

National Lead Co.
2100 Smead Ave.
Toledo 1, Ohio
Metals: A, B, C, D, E, F
Services: M, F, A

National Lock Co.
1902 Seventh St.
Rockford, Ill.
Metals: A, B
Services: M, F, A

National Metal Products Co.
10th & Eastern Ave.
Cornersville, Ind.
Metals: B
Services: M, F, A

Nelmor Mfg. Corp.
26420 Lakeland Blvd.
Euclid, Ohio
Metals: A, B
Services: M, F, A

Nelson Metal Products* **
Div. Midland-Ross Corp.
510 32nd St., S.E.
Grand Rapids 8, Mich.
Metals: A, B
Services: M, F, A

New England Die Casting Co.
445 Front Ave.
West Haven 5, Conn.
Metals: A, B
Services: M, F, A

New England Tool Corp.
53 Houghton St.
Hudson, Mass.
Metals: A, B, E
Services: M, F, A

Newton-New Haven Co.* **
680 Third Ave.
New Haven, Conn.
Metals: A, B
Services: M, F, A

Nichols Industries, Inc.
P.O. Box 1191
Jacksonville, Texas
Metals: B
Services: M, F, A

Nichols Tool & Die
1831 N. Killingsworth
Portland 17, Ore.
Metals: B
Services: M, F, A

Norgren-Stemac**
Div. of C. A. Norgren Co.
5400 S. Delaware
Littleton, Colo.
Metals: B
Services: M, F, A

Norlipp Co.
5925 S. Lowe Ave.
Chicago 21, Ill.
Metals: B
Services: M, F, A

North & Judd Mfg. Co.
500 E. Main St.
New Britain, Conn.
Metals: A, B
Services: M, F, A

Northern Iowa Die Casting, Inc.
P.O. Box "K"
Milford, Iowa
Metals: B
Services: M, F, A

Northern Star Plating Co.
505 Riversland Rd.
Loves Park, Ill.
Metals: B
Services: M, F, A

Norwood Tool & Machine Co.
1952 Thomas St.
Three Rivers, Mich.
Metals: B
Services: M, F, A

Ohio Die Casting Corp.
3083 Silver Dr.
Columbus 14, Ohio
Metals: A, B
Services: M, F, A

Oren Products Co.
19950 Ingersoll Dr.
Rocky River, Ohio
Metals: A, B
Services: M, F, A

Oswego Castings Corp., Sub. of*
Oberdorfer Foundries, Inc.
Box 222
Oswego, N.Y.
Metals: A
Services: M, F, A

Pabcast*
355 W. Alondra Blvd.
Gardena, Calif.
Metals: A, C, D
Services: M, A

Page & Hall Die Casting Co., Inc.
1600 Hyde Park Ave.
Boston 36, Mass.
Metals: A, B
Services: M, F, A

Paragon Die Casting Co.* **
5651 W. Dickens Ave.
Chicago 39, Ill.
Metals: A, B
Services: M, F, A

Paramount Die Casting Co.
Freeman Field
Seymour, Ind.
Metals: A, B
Services: M, F, A

**Paramount Die Casting Co.* **
U.S. Highway 12
St. Joseph 1, Mich.
Metals: A, B, C
Services: M, F, A

Parker White Metal Co.* **
2153 McKinley Ave.
Erie, Pa.
Metals: A, B, D, E, F
Services: M, F, A

Parsons Casket Hardware Co.
424 Fairview St.
Belvidere, Ill.
Metals: B
Services: M, F

**Peasley Products, Inc.* **
993 Honeyspot Rd.
Stratford, Conn.
Metals: A, B
Services: M, F, A

**Peat Mfg. Co.* **
Div. Textron, Inc.
10700 E. Firestone Blvd.
Norwalk, Calif.
Metals: A, B
Services: M, F, A

Peerless Aluminum Foundry Co.*
55 Andover St.
Bridgeport, Conn.
Metals: A
Services: M, F, A

Peterson's Machine Shop
258 Russell St.
Lewiston, Maine
Metals: A, B
Services: M, A

Petoskey Mfg. Co.
200 W. Lake St.
Petoskey, Mich.
Metals: B
Services: M, F, A

Ben Phillips Nameplates
132 W. Verdugo Ave.
Burbank, Calif.
Metals: B
Services: M, F, A

**Pioneer Diecasters, Inc.* **
4209 Chevy Chase Dr.
Los Angeles 39, Calif.
Metals: A, B
Services: M, A

Pittsburgh Die & Casting Co.* **
7503 Ardmore St.
Pittsburgh 18, Pa.
Metals: A, B
Services: M, F, A

Pomona Die Casting Corp.
4253 State St.
Pomona, Calif.
Metals: A, B, C
Services: M, F, A

Power Brake Equipment Co.
1632 S.E. 11th Ave.
Portland 14, Ore.
Metals: B
Services: M, F, A

Precise Castings, Inc.
2442 Madison Ave.
Anderson, Indiana
Metals: A
Services: M, F

**Precision Castings Co.* **
12600 Berea Road
Cleveland 11, Ohio
Metals: A, B, C
Services: M, F, A

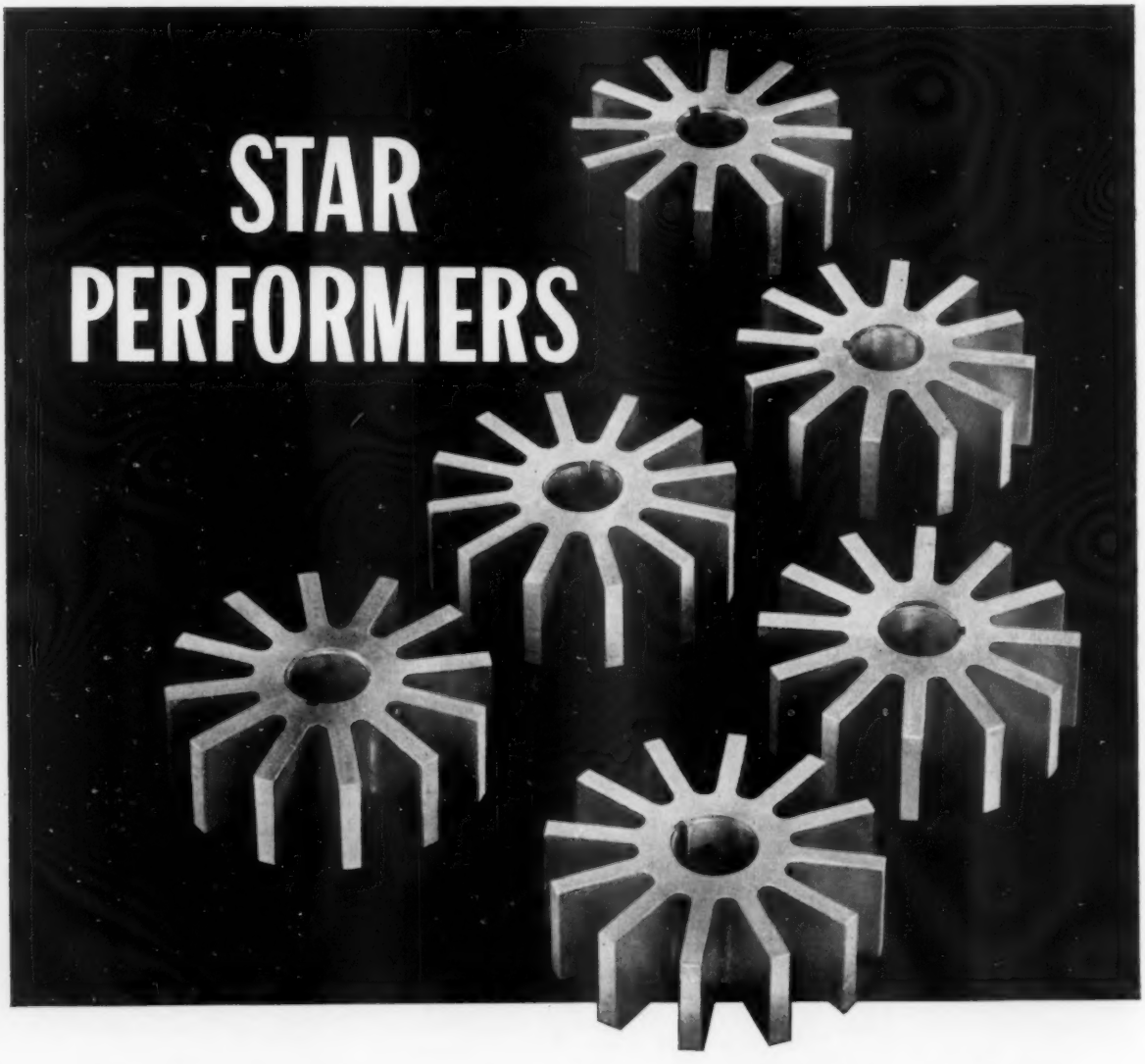
Premier Die Casting Co.
28 Margaretta St.
Newark 5, N.J.
Metals: A, B
Services: M, F, A

Pressco Casting & Mfg. Corp.
Broadway & Waverly Rd.
Chesterton, Ind.
Metals: A, D
Services: M, F, A

Pressure Castings of Canada Ltd.
1777 Weston Rd.
Weston, Ont., Canada
Metals: A, B
Services: M, F, A

Pressure Castings, Inc.* **
21500 St. Clair Ave.
Cleveland 17, Ohio
Metals: A, B
Services: M, A

For a description of the symbols refer to page 71.



Madison-Kipp zinc and aluminum die castings

Impellers for a ventilator pump must be held to extremely close tolerances.

Madison-Kipp showed the way to produce these parts with a bare minimum of secondary operations.

If it is an intricate shape, a question of close tolerance, a problem of casting-in inserts or just a dependable source for quality castings in quantity, the engineering skill, die making experience and years of manufacturing background of Madison-Kipp are available to you.

We have a 24-page book showing some of the die casting problems we have solved, and containing information on other Madison-Kipp products. A copy is yours for the asking.

kipp

MADISON-KIPP CORPORATION

213 Waubesa Street • Madison 10, Wisconsin, U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High-Speed Air Tools

Circle No. 57 on Reader Service Card

Proctor Metal Products
629 Hill Ave.—P.O. Box 1011
New Braunfels, Texas
Metals: A, B
Services: M, F, A

Product Engineering Co.
15227 S.E. Meadowbrook Ln.
Milwaukee, Oregon
Metals: A, B
Services: M, F, A

Product Engineering Co.
4707 S.E. 17th Ave.
Portland 2, Oreg.
Metals: A, B
Services: M, F, A

Product Engineering & Mfg. Corp.
Box 35
Bridgman, Mich.
Metals: A, B
Services: M, F, A

Production Aluminum Co.
338 Wealthy S.W.
Grand Rapids 3, Mich.
Metals: A
Services: M, F, A

Production Die Casting Co.* **
6502 Rusk Ave.
Houston 11, Tex.
Metals: A, B
Services: M, F, A

Production Mold & Mach. Co.
2112 Leota St.
Huntington Park, Calif.
Metals: B
Services: M, A

Products Engineering & Mfg. Co.
569 Hulmeville Ave.
Penndel, Pa.
Metals: A, B
Services: M, F, A

Puget Casting Co.
2101 S. Mildred
Tacoma 66, Wash.
Metals: A, B, C, D
Services: M, F, A

Quad-City Die Casting Co.* **
3800 River Dr.
Moline, Ill.
Metals: A, B
Services: M

Quality Metal Finishing Co.
Byron, Ill.
Metals: B
Services: M, F, A

Racine Die Casting Co.
1500 16th St.
Racine, Wis.
Metals: A, B
Services: M, F

Rangers Die Casting Co.*
10828 S. Alameda
Lynwood, Calif.
Metals: A

Redl Industries Ltd.
2346 Clarke St., P.O. Box 105
Port Moody, B.C., Canada
Metals: B, E
Services: M, F, A

Reese Padlock Co.
128 Sherman St.
Lancaster, Pa.
Metals: B
Services: M, F, A

A. C. Rehberger Co.
2134 N. Magnolia Ave.
Chicago 14, Ill.
Metals: B, E, F
Services: M, F, A

Republic Die Casting Div.* **
Landers, Frary & Clark
P.O. Box 1447
Ft. Smith, Ark.
Metals: A, B
Services: M, F, A

Rhode Island Die Casting Co.
669 Elmwood Ave.
Providence 7, R.I.
Metals: A, B, E
Services: M, F, A

Richmond Machine Tool & Die Casting Co., Ltd.
5680 Fullum St.
Montreal 36, Quebec, Can.
Metals: A, B
Services: M, F

Roberts Engineering & Mfg. Co., Inc.
Box 4060, 640 Navigation
Corpus Christi, Texas
Metals: A, B, E, F
Services: M, F, A

Rocklin Mfg. Co.
110 S. Jennings St.
Sioux City, Iowa
Metals: A, B
Services: M, F, A

Rockwell Corp.
Pittsburgh Dubois Div.
Main St.
Sykesville, Pa.
Metals: E, F
Services: M, F, A

Roos Mfg. Co.
197 E. Sac Ave.
Chico, Calif.
Metals: B
Services: M, F, A

Ross Sprinkler Co.
4333 Temple City Blvd.
Rosemead, Calif.
Metals: B
Services: M, F, A

Rowe Plastics & Die Casting Co.
2640 N. Southport Ave.
Chicago 14, Ill.
Metals: A, B
Services: M, F, A

Rubor Tool & Die Co.
1819 Utica Ave.
Brooklyn 34, N.Y.
Metals: B
Services: M, F, A

Rupert Diecasting Div.
Pierce Industries, Inc.
1655 Cleveland Ave.
Kansas City 27, Mo.
Metals: A, B
Services: M, F, A

Rutherford Bros. Plating Co.
7 Emerick St.
Ypsilanti, Mich.
Metals: B
Services: M, F, A

S.K.S. Die Casting Co.
739 Allston Way
Berkeley 2, Calif.
Metals: A, B
Services: M, F, A

Saginaw Bay Industries, Inc.
242 N. Water St.
Bay City, Mich.
Metals: A, C
Services: M, F

St. Louis Diecasting Corp.* **
4528 Oleatha Ave.
St. Louis 16, Mo.
Metals: A, B
Services: M, F, A

San Jose Die Casting Corp.
815 Chestnut St.
San Jose 10, Calif.
Metals: A, B, D
Services: M

Sargeant & Greenleaf, Inc.
24 Seneca Ave.
Rochester 21, N.Y.
Metals: A, B, D
Services: M, F, A

Scherer Die Casting Co.
Alyce Ave.
Cedarburg, Wis.
Metals: A
Services: M, F

Schultz Die Casting Co.* **
1810-16 Clinton St.
Toledo 7, Ohio
Metals: A, B
Services: M, F, A

Schultz Die Casting of Canada, Ltd.* **
77 St. David St.
Lindsay, Ontario, Canada
Metals: B
Services: M, F, A

Seaboard Die Casting Co.
1125 Prospect Ave.
West Islip, L.I., N.Y.
Metals: B
Services: M, F

Serv-All Die & Tool Co.
P.O. Box 117
Crystal Lake, Ill.
Metals: B
Services: M, F, A

Sheldon Die Casting Co.
Sub. of Le Sueur Foundry Inc.
Le Sueur, Minn.
Metals: A, B
Services: M, F, A

Sherman Pressure Casting Co.* **
601 W. 26th St.
New York 1, N.Y.
Metals: A, B, C
Services: M, F, A

Skulsky Mfg. Co.
250 Moore St.
Brooklyn 6, N.Y.
Metals: B
Services: F, A

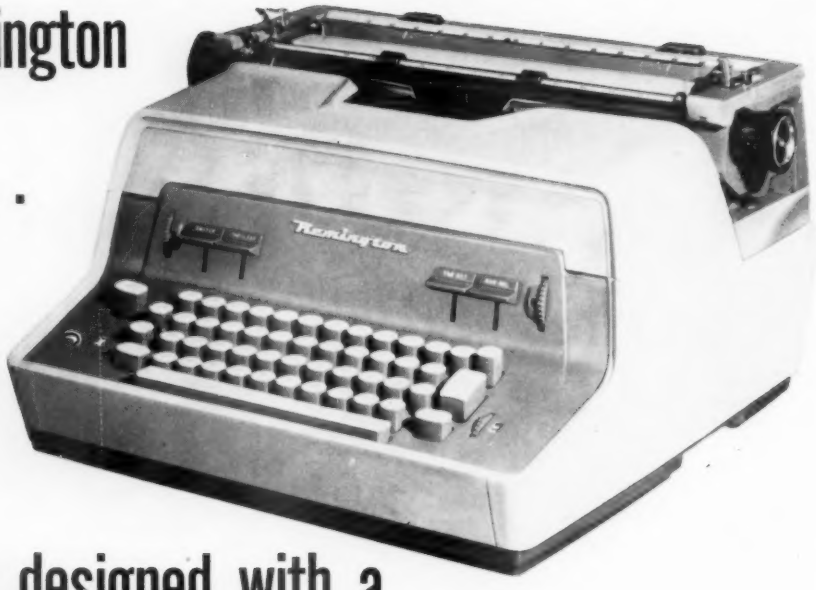
Soper Mfg. Co.
1099 Milton St.
Benton Harbor, Mich.
Metals: B
Services: M, A

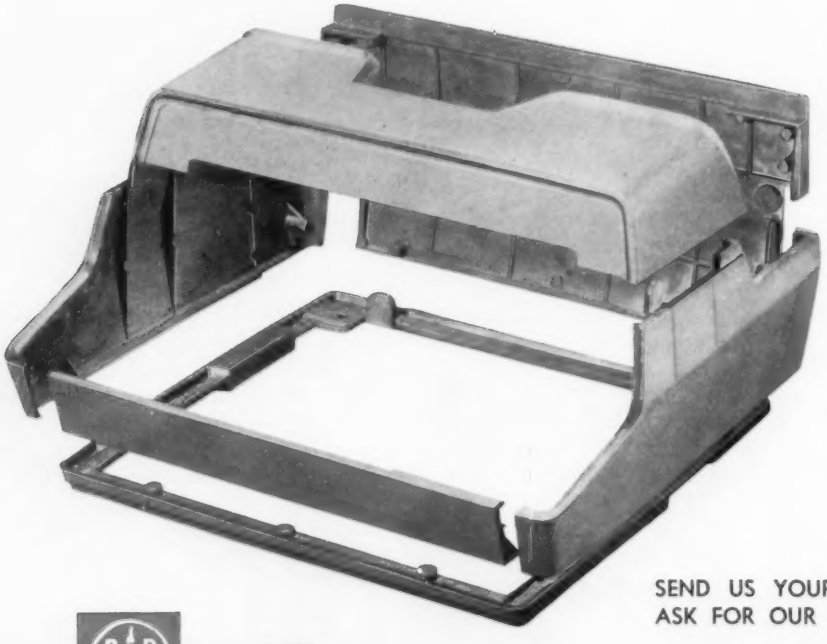
Southern Die Casting Co.
17511 S.W. 99th Rd.
Perrine, Fla.
Metals: B
Services: M, F, A

Southern Industrial Die Casting Corp.
Box 21
Moultrie, Ga.
Metals: A B,
Services: M

For a description of the symbols refer to page 71.

The new Remington Electric is . . . stronger, lighter, more stylishly designed with a *Premier* aluminum die cast housing





DESIGNED FOR DIE CASTING AT PREMIER where quality zinc and aluminum die castings are made. Let Premier solve your design and production problems on *any* business machine.

- VACUUM CASTING
- AUTOMATIC LADLING

for

Thinner Wall Sections
Minimum Porosity
Constant Quality
Improved Surfaces

SEND US YOUR PRINT FOR QUOTATIONS.
ASK FOR OUR FREE FACILITIES BROCHURE.

Premier **DIE CASTING COMPANY**

24 MARGARETTA STREET • NEWARK 5, NEW JERSEY

Circle No. 73 on Reader Service Card

PRECISION METAL MOLDING

J. W. Speaker Corp.
3059 N. Weil St.
Milwaukee 12, Wis.
Metals: B
Services: M, F

Speedmaster Engineering Co.
900 Doolittle Dr.
San Leandro, Calif.
Metals: A, B, D
Services: M, F, A

Spencer Die Casting
9651 S. Alameda
Los Angeles, Calif.
Metals: A, B, C, D
Services: M, F, A

Standard Brass Corp.
Belvidere, Ill.
Metals: B
Services: M, F, A

Standard Record Mfg. Co.
70 N. San Gabriel Blvd.
Pasadena, Calif.
Metals: A, B, E
Services: M, F, A

Star Casting Corp.
102 Prince St.
New York 13, N.Y.
Metals: B
Services: M, F, A

Staver Co., Inc.
41 N. Saxon St.
Bay Shore, L.I., N.Y.
Metals: E
Services: M, A

Stella Products Corp.* **
66 Okner Pkwy.
Livingston, N.J.
Metals: B
Services: M, A

Sterling Aluminum Products, Inc.
2600 N. Third
St. Charles, Mo.
Metals: A
Services: M, F

Sterling Die Casting Co., Inc.* **
743 39th St.
Brooklyn 32, N.Y.
Metals: A, B
Services: M, F

Stewart-Warner Corp.
Stewart Die Casting Div.
4535 Fullerton Ave.
Chicago 39, Ill.
Metals: A, B, C
Services: M, F, A

Strite-Anderson Mfg. Co.
1920 Washington Ave., S.
Minneapolis 4, Minn.
Metals: A, B
Services: M, A

Stroh Die Casting Co., Inc.* **
11123 W. Burleigh St.
Milwaukee 10, Wis.
Metals: A, B
Services: M, F, A

Super Grip Anchor Bolt Co.
3333 N. 22nd St.
Philadelphia 40, Pa.
Metals: B, E
Services: M, F, A

Super Mold Corp.
420 N. Sacramento
Lodi, Calif.
Metals: A
Services: M, F, A

Superior Die Casting Co.* **
1001 London Rd.
Cleveland 10, Ohio
Metals: A, B, D
Services: M, F

Syracuse Die Casting & Mfg. Co.
2101 Teall Ave.
East Syracuse, N.Y.
Metals: A, B, E, F
Services: M, F, A

Tann Corp.
Congress Die Casting Div.
3750 E. Outer Dr.
Detroit 34, Mich.
Metals: B
Services: M, F, A

J. Y. Taylor Mfg. Co.
Box 529
Garland, Texas
Metals: A, B
Services: M, F, A

Techni-Cast Corp.* **
600 Walnut St.
Hamilton, Ohio
Metals: A, B
Services: M, F, A

Terry Burners, Inc.
5105 Buchan St.
Montreal, Que., Canada
Metals: A, B
Services: M, F

Thompson Die Casting, Inc.
120 W. Elm Ct.
Burbank, Calif.
Metals: B
Services: M, F, A

Thompson-Ramo Wooldridge, Inc.
Light Metals Div.
2269 Ashland Rd.
Cleveland 3, Ohio
Metals: A, C
Services: M, F, A

E. Toman & Co.
8700 W. 47th St.
Lyons, Ill.
Metals: A, B
Services: M, F, A

Tool-Die Engineering Co.* **
3878 E. 93rd St.
Cleveland 5, Ohio
Metals: A, B
Services: M

Toroy Die Casting Corp.
765 Elmont Rd.
Elmont, N.Y.
Metals: A, B, E
Services: M, F, A

Trilex Corp.
44052 Yost Rd.
Wayne, Mich.
Metals: B
Services: M, F, A

Twin City Die Castings Co.* **
Talmage & 33rd Ave. S.E.
Minneapolis 14, Minn.
Metals: A, B, E
Services: M, F, A

U.S. Expansion Bolt Co.
York, Pa.
Metals: B, E
Services: M, F, A

Unimatic Mfg. Co.
Sherwood Lane
Caldwell, N.J.
Metals: A
Services: M, F, A

Union Die Casting Co.* **
676 Putnam Dr.
Whittier, Calif.
Metals: A, B
Services: M, F, A

Universal Die Casting Co.* **
5001 Santa Fe Ave.
Los Angeles 58, Calif.
Metals: A, B, D
Services: M, F, A

Universal Die Casting Corp.
3500 N.W. 59th St.
Miami 42, Fla.
Metals: A, B
Services: M, F, A

Univex Die Cast & Engineering
7001 Chase Rd.
Dearborn, Mich.
Metals: B, E
Services: M, F, A

Valley Die Cast Corp.
1791 Bellevue
Detroit 7, Mich.
Metals: B
Services: M, F, A

Van Wey Die Casting & Tooling
2366 Bay Road
Redwood City, Calif.
Metals: A, B
Services: M

Veeder-Root, Inc.
28 Sargeant St.
Hartford 2, Conn.
Metals: A, B
Services: M, F, A

Walker Metal Products
P.O. Box 315
Lewisburg, Tenn.
Metals: B
Services: M, A

Watchung Die Casting Corp.* **
P.O. Box 828
Plainfield, N.J.
Metals: A, B
Services: M, A

Waterbury Lock & Specialty
203 Broad St.
Milford, Conn.
Metals: B
Services: M, F, A

Wayland Co.
2632 W. Grand Ave.
Chicago 12, Ill.
Metals: A, B
Services: M, F, A

Weatherhead Co.
Fort Wayne Div.
Antwerp Plant
Antwerp, Ohio
Metals: B
Services: M, F, A

Webster Air Equipment Co., Ltd.
1161 King St.
London, Ontario, Canada
Metals: B
Services: M, F, A

Wells Die Casting of Calif.* **
1960 Carroll Ave.
San Francisco 24, Calif.
Metals: A, B, D
Services: M, A

Wells Mfg. Co.
New Vienna, Ohio
Metals: B
Services: M, F, A

For a description of the symbols refer to page 71.

Wessel Hardware Corp.
919-931 North Fifth St.
Philadelphia, Pa.
Metals: B
Services: M, F, A

West Irving Die Casting Co.
240 S. Evergreen
Bensenville, Ill.
Metals: A
Services: M, F

Western Die Casting Co.* **
4065 Hollis St.
Emeryville 8, Calif.
Metals: A, B, C, D
Services: M, F, A

Westinghouse Electric Co.
653 Page Blvd.
Springfield, Mass.
Metals: A, B
Services: M, F, A

Westinghouse Electric Corp.
1216 W. 58th St.
Cleveland, Ohio
Metals: A
Services: M, F, A

Westland Die Casting, Inc.* **
714 Ruberta Ave.
Glendale 1, Calif.
Metals: A, B
Services: M, F, A

Wheaton Die Casting Corp.* **
North 10th St.
Millville, N.J.
Metals: A, B
Services: M, F, A

White Die Casting Co.
Mac Nab St. at Head
Dundas, Ontario, Canada
Metals: A, B
Services: M, F, A

White Industries, Inc.
1325 E. 171 St.
Cleveland 10, Ohio
Metals: A, B
Services: M, A

Whitehead Die Casting Co.
1198 Zonolite Rd. N.E.
Atlanta 6, Ga.
Metals: A, B
Services: M, F, A

David L. Wilkoff Co., Inc.
150 Broadway
New York 38, N.Y.
Metals: A, B, C, D
Services: M, F

Wise Die Casting Corp.
98 Olean St.
Rochester 8, N.Y.
Metals: B
Services: M, F, A

**Withrow Die Casting Co.* **
13164 Leadwell St.
North Hollywood, Calif.
Metals: A, B, D
Services: M, A

Wolverine Die Cast Corp.
13700 Mt. Elliott
Detroit 12, Mich.
Metals: A, B
Services: M, F, A

World Metal Spinning Corp.
Commercial St.
Hicksville, L.I., N.Y.
Metals: B

Yoder Die Casting, Inc.* **
727 Kiser St.
Dayton 4, Ohio
Metals: A, B
Services: M, F, A

Yoder Industries
1040 E. First St.
Dayton 2, Ohio
Metals: A, B, E, F
Services: M, F

For a description of the symbols refer to page 71.

DIE CASTERS OF SPECIAL ALLOYS BY METALS

DIE CASTERS OF SPECIAL ALLOYS—All alloys other than aluminum and zinc are listed both in the preceding Buyer's Guide and in the following guide, which is categorized by metal.

ALUMINUM BRONZE

Aurora Metal Co.

BABBITT

Yoder Industries

BRASS

Action-Hopkins Machine & Foundry Co.
Adco Die Cast Co., Inc.
Alacast Corp.
Anderson Die Casting Co.
Atherton Tool, Die & Mold Co.
Barber Die Casting Co., Ltd.
Benda Tool & Model Works
Blue Ridge Pressure Casting, Inc.
Bucy Diecasting
Casper's Machine Shop
W. L. Chapman Co., Inc.
D & M Die Cast Co.
Dialoy Inc.
Di-Cast Mfg. Co.
Diecasters, Inc.
Doehler-Jarvis Div.
National Lead Co.
Engineering Cast Products
Florida Fishing Tackle Mfg. Co., Inc.
General Electric Co.
Erie Foundries
Glendale Products
Harvill Corp.
H. L. Harvill Mfg. Co.
Hoover Ball & Bearing Co.
Glenvale Products Div.
Kohler Corp.
Los Angeles Die Casting Co.
Magnesium, Inc.
National Die Casting Co.
National Lead Co.
Pabcast
Parker White Metal Co.
Pressco Casting & Mfg. Corp.
Puget Casting Co.
San Jose Die Casting Corp.
Sargeant & Greenleaf, Inc.
Speedmaster Engineering Co.
Spencer Die Casting
Superior Die Casting Co.
Universal Die Casting Co.
Wells Die Casting of California
Western Die Casting Co.
David L. Wilkoff Co., Inc.
Withrow Die Casting Co.

LEAD

Ability Die Casting Co.
Acme Tool & Die Casting Co.
Action-Hopkins Machine & Foundry Co.
Ajax Die Casting & Mfg. Co.
Alacast Corp.
Ambrit Industries
Amplex Engineering Co.
Argo Die Casting Inc.
Arro Expansion Bolt Co.
Beaut Mfg. Co.
Belden Manufacturing Co.
Benda Tool & Model Works
Calko Die Casting Co.
Carpenter Die Casting Co., Ltd.
Chautauqua Hardware Corp.
Chicago Die Casting Mfg. Co.
Chicago Expansion Bolt Co.
Comet Metal Products Co., Inc.
Cordray Die Casting Co.
Crescent Co.
Crown Novelty Works
Dayton Die Casting Co.
Die Cast & Forge Corp.
Die Cast Products, Inc.
Fisher Gauge Works, Ltd.
Florida Fishing Tackle Mfg. Co., Inc.
Food Machinery & Chemical Corp.
Forster-Appelt Mfg. Co., Inc.
Fort Worth Die Cast Co., Inc.
Gasket Packing & Specialty Co., Inc.
Gemco Mfg. Co., Inc.
C. M. Grey Industries, Inc.
Hall Level Mfg. Works
Harrelson Mfg. Co.
Hooper Die Casting Co.
Kohler Corp.
Latrobe Die Casting Co.
Lukens Aluminum Co.
Milwaukee Die Casting Co.
National Lead Co.
New England Tool Corp.

Parker White Metal Co.
Redl Industries Ltd.
A. C. Rehberger Co.
Rhode Island Die Casting Co.
Roberts Engineering & Mfg. Co., Inc.
Rockwell Corp.
Pittsburgh Dubois Div.
Standard Record Mfg. Co.
Staver Company, Inc.
Super Grip Anchor Bolt Co.
Syracuse Die Casting & Mfg. Co.
Toroy Die Casting Corp.
Twin City Die Castings Co.
Univex Die Cast & Engineering
U. S. Expansion Bolt Co.
Yoder Industries

MAGNESIUM

Acme Tool & Die Casting Co.
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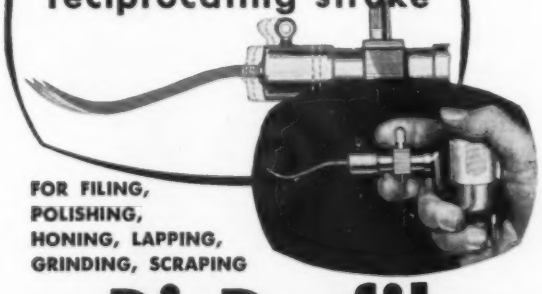

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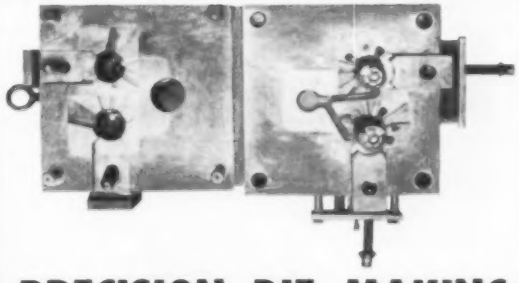

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REED-PRENTICE
DIE CASTING NEWSLETTER

Hood or 'hoodless' vacuum die casting ...which offers you more?

Within the past few years interest in vacuum die casting has grown to a point where few, if any, major companies have not at least considered it. On both hot and cold chamber machines, the results that can be consistently obtained with vacuum operation have proved its worth.

Now one of the main questions is: What type of system should I buy? What advantages does the use of a hood, with the die moving in a vacuum, have over the 'hoodless' systems which evacuate the die after closure.

Variations with 'hoodless'

Reducing and holding air pressure at a predetermined level is extremely difficult without the aid of a hood. Even the use of very high vacuum to offset leakage across the die face offers no guarantee of consistency from shot to shot.

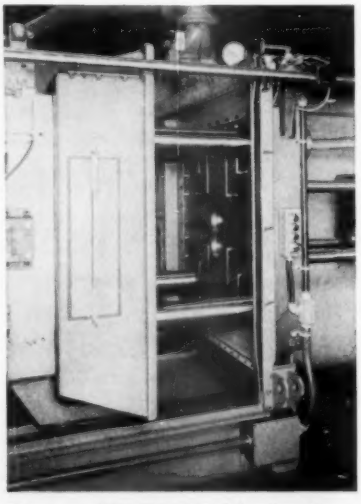
One general result is a degree of variation in metal flow which can affect both the surface finish and density of castings.

The use of a hooded system, where the vacuum is pulled *before* the die is closed, can eliminate such variables. This is the case in both the VACUCAST (zinc) and VACUFEED (aluminum) systems which have been developed by REED-PRENTICE.

More uniform operation

With a constant casting temperature, uniform evacuation is achieved on each shot with lower vacuums. This in itself helps assure a more completely uniform metal flow, an extremely important factor in the successful production of larger, thin walled castings that only vacuum operation makes possible.

This ability to handle difficult shots on either the VACUCAST or VACUFEED will continue to broaden die casting's uses. The design engineer can specify vacuum casting with confidence . . . the die caster knows he has far greater latitude in the jobs he can undertake.



Close-up of VACUFEED (aluminum) machine shows how the compact hood completely encloses the die area to offset leakage, protect operator against flash.

Die conversion, design

It is usually far simpler to convert existing dies to use in a hooded system. No provision need be made to eliminate leakage of air across the face, since the entire die operates within a vacuum. While gating must sometimes be altered, it is often possible to follow practices that would be impossible with standard equipment and are to the user's advantage.

Design of new dies for vacuum use with the REED-PRENTICE system can be simpler. The fact that it is better to design to one standard die thickness helps reduce set-up time.

Other advantages

In day-to-day operation, REED-PRENTICE vacuum equipment offers many benefits beyond obvious user advantages like the reduction of rejects. Zinc parts cast on VACUCAST machines can have superior surface and plating properties. On the VACUFEED, with its automatic ladling, it is practical to cast with aluminum alloys that cannot be used on standard equipment. Parts are cleaner, lighter, need less finishing.

First and foremost, this complete equipment is manufactured only by REED-PRENTICE. If you would like full details on either the zinc or aluminum vacuum system . . . how it can be applied to your operation . . . contact your nearest REED-PRENTICE Sales Engineer today.

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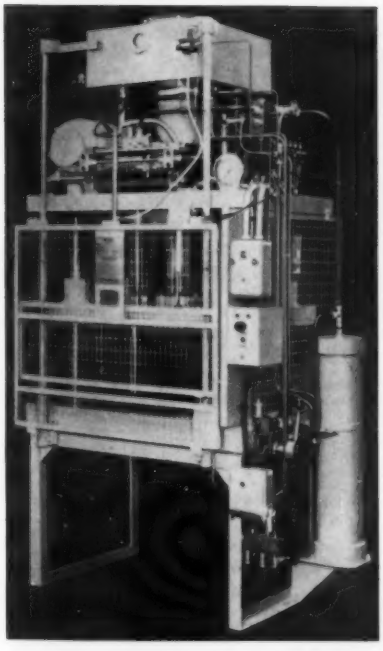

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Mid-State Die Casting Co., 7878 S. Division Ave., Grand Rapids 8

Monarch Governor Co., 2800 Tyler Rd. Willow Run

Mutual Plating & Die Casting Co., 25611 W. 8 Mile Rd., Detroit 40

Nelson Metal Products, Div. Midland-Ross Corp., 510 32nd St., S.E., Grand Rapids 8

Norwood Tool & Machine Co., 1952 Thomas St., Three Rivers

Paramount Die Casting Co., U.S. Highway 12, St. Joseph

Petoskey Mfg. Co., 200 W. Lake St. Petoskey

Product Engineering & Manufacturing Corp. Box 35, Bridgman

Production Aluminum Co., 338 Wealthy S.W., Grand Rapids 3

Rutherford Bros. Plating Co., 7 Emerick St. Ypsilanti

Saginaw Bay Industries, Inc., 242 N. Water St., Bay City

Soper Mfg. Co., 1099 Milton St., Benton Harbor

Tann Corp., Congress Die Casting Div. 3750 E. Outer Dr., Detroit 34

Trilex Corp., 44052 Yost Rd., Wayne

Univex Die Cast & Engineering, 7001 Chase Rd., Dearborn

Valley Die Cast Corp., 1791 Bellevue, Detroit 7

Wolverine Die Cast Corp., 13700 Mt. Elliott, Detroit 12.

MINNESOTA

Char-Lynn Co, 2843 26th Ave., S. Minneapolis 6

Douglas-Stemac, Inc., 620 12th Ave., S. Minneapolis 4

Hartzell Mfg., Inc., 2516 Wabash Ave., St. Paul 14

Joyner Silver & Electro-Plating Co. Osseo

Lake Center Switch Co., 51 Johnson St. Winona

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The direct chill method of casting has practically eliminated all of the objectionable defects that are present in most static castings. Because of the controls available to vary the casting conditions, billets cast by this method are particularly sound and free from segregation, porosity, and inclusions. Grain size and structure can be controlled or varied for different applications.

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Permanent Mold Die Company is a pioneer in the direct chill casting process. Through the research facilities of PMD, better casting methods are constantly being devised . . . methods that insure higher quality castings at lower costs. And remember, a Permanent Mold Die Co. engineer is available to anyone having die casting or tooling problems.

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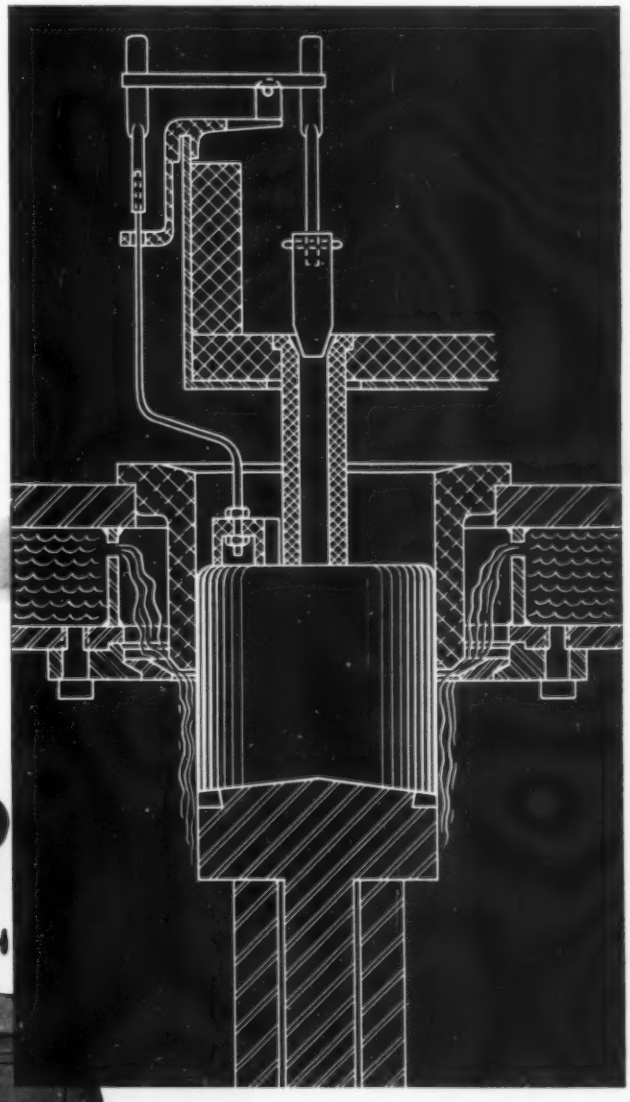

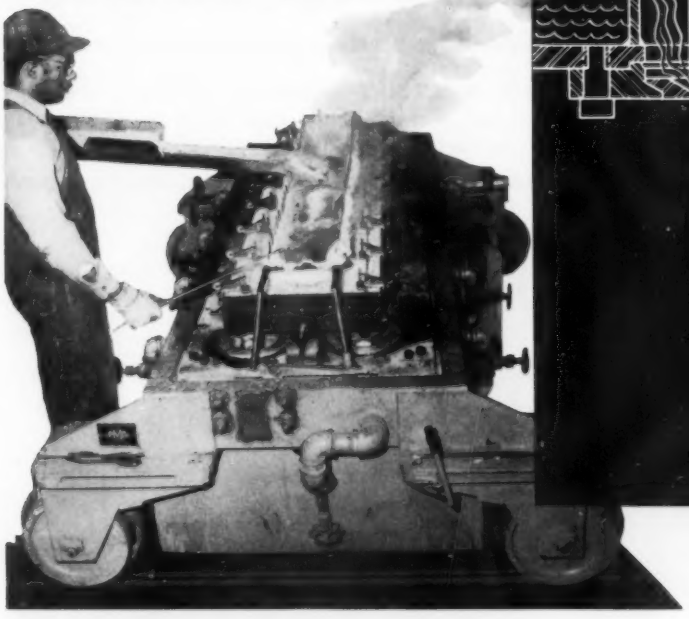

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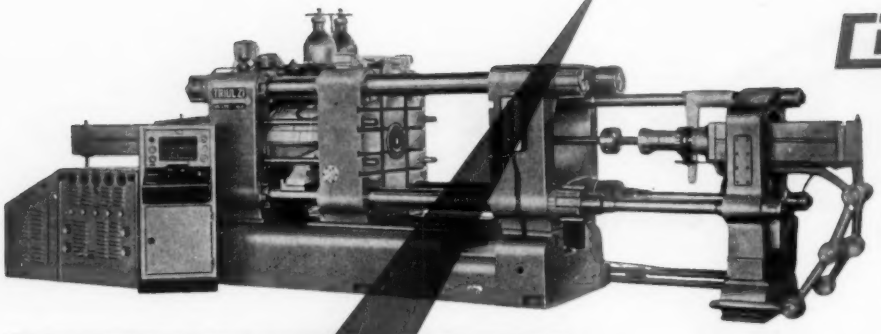

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cold chamber

- oil hydraulic
- automatic
- wedge lock positive clamping
- platens adjusted by motorized central screw
- electric panel for choosing **8 different working programs**
- working speeds up to **400** dry cycles per hour

Characteristics	Mod:	135	220	700	1,000
Max. shot capacity (Al.)	pounds	3.0	11.9	18.7	31.5
locking force	U.S. Tons	165	550	770	1,100
Max. Thickness of the die	inches	24	29.5	22	39.5
platens adjustment	inches	14	18	8	20
opening stroke	inches	14	18	26	27.5
dry cycles	per hour	330/550	350/450	250/400	250/360

DIE CASTING MACHINES

- **cold chamber, horizontal and vertical from 135 to 2500 U.S. Tons**
- **hot chamber, from 135 to 1100 U.S. Tons**

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- electric panel for choosing **8 different working programs**
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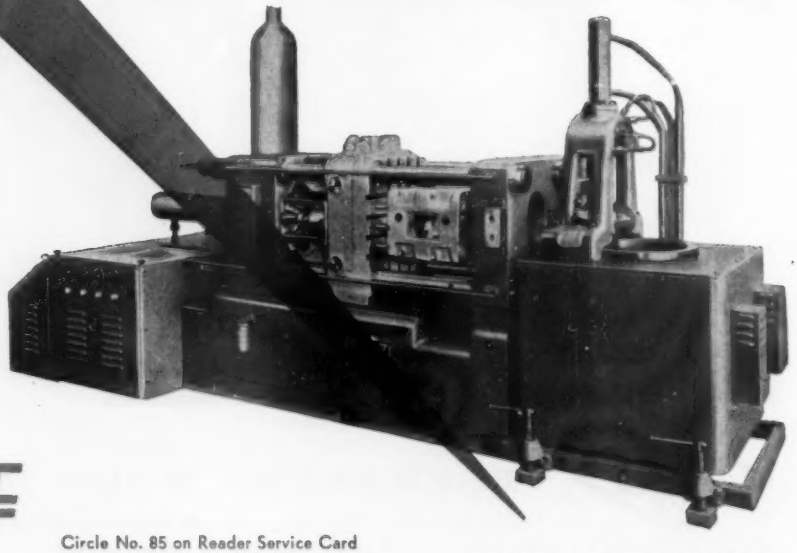

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Sheldon Die Casting Co., Sub of Le Sueur Foundry Inc., Le Sueur

Strite-Anderson Mfg. Co., 1920 Washington Ave. S., Minneapolis 4

Twin City Die Castings Co., Talmage & 33rd Ave. S.E., Minneapolis 14

MISSISSIPPI

Harrelson Mfg. Co., Calhoun City

MISSOURI

Kuhlman Die Casting Co., 7300 E. 17th St. Kansas City 3

Lyons Die Casting Co., Buckner

Missouri Diecasting Div., Pierce Industries, Inc., 1411 N. 17th St., St. Louis 6

Monroe City Die Casting Co., 135 Front St., Monroe City

A. B. Mueller Co., 2101 E. John St. St. Louis 7

Rupert Diecasting Div., Pierce Industries, Inc., 1655 Cleveland Ave., Kansas City 27

St. Louis Diecasting Corp., 4528 Oleatha Ave., St. Louis 16

Sterling Aluminum Products, Inc., 2600 N. Third, St. Charles

NEBRASKA

Morton Mfg. Co., Inc., 7025 Sarpy Ave. Omaha 47

NEW HAMPSHIRE

Nashua Corp., 44 Franklin St., Nashua

NEW JERSEY

Advance Pressure Castings, Corp., 276 State Highway #53, Denville

Aluminum Co. of America Edison

American Aluminum Casting Co., 324 Coit St., Irvington 11

Art Jack Die Casters, Inc., 196 Murray St. Newark 5

Beaut Mfg. Co., 7500 Tonnelle Ave. North Bergen

Camp Aircraft Parts, 1133-39 McCarter Hwy., Newark 2

Diecasters, Inc., 90 Herbert Ave., Closter

Dollin Corp., 600 S. 21st St., Irvington 11

Du-Rite Die Casting Corp., 239 Watchung Ave., W. Orange

Duane Specialties Ltd., 2 Johnson St. Newark 5

Esquire Novelty Corp., 151 West Side Ave., Jersey City

Federal Aluminum Foundry Co., 411 Williams St., Camden

C. M. Grey Industries, Inc., 358 Central Ave., E. Orange

Harbot Die Casting Corp., 52 E. Centre St., Nutley

Haug Die Casting Corp., 356 W. 1st Ave. Roselle

Hooper Die Casting Co., 623 Prospect St. Trenton 8

Jersey Plastic & Die Casting Co., 149-165 Shaw Ave., Irvington 11

Micro Products Engineering Co., 234-40 Ridgewood Ave., Newark 8

Premier Die Casting Co., 28 Margaretta St. Newark 5

Stella Products Corp., 66 Okner Pkwy. Livingston

Unimatic Mfg. Co., Sherwood Lane Caldwell

Watchung Die Casting Corp., P. O. Box 828, Plainfield

Wheaton Die Casting Corp., North 10th St., Millville

NEW YORK

Adept Castings, Inc., S. Henrietta St. Hicksville

Allen-Stevens Corp., 62 St. & 34 Ave. Woodside 77

Argo Die Casting, Inc., 106 Powerhouse Rd., Roslyn Hts., L.I.

Cast-O-Matic Corp., P. O. Box 1172 Syracuse 1

Chautauqua Hardware Corp., 31 Water St., Jamestown

Comet Metal Products Co., Inc., 91-05 132 St., Richmond Hill 18

Crown Novelty Works, 85-15 Liberty Ave. Ozone Park 17

Davis Products Corp., 601-39th St. Brooklyn 32

Die Cast & Forge Corp., 190 Petersville Rd., New Rochelle

Dieco Die Casting Co., 59-27 Decatur St. Ridgewood 27

Dryad Die Casting Co., North Ave. Manchester

Dual Die Casting, 625 S. Columbus Ave. Mt. Vernon

Earl Electric Mfg. Corp., 35-20 Borden Ave., Long Island City 1

Eastern Casting Corp., 64 S. William St. Newburgh

Falconer Metal Specialties Co., Inc. Winchester Rd., Lakewood

Finkel Umbrella Frame Co., Inc., 2534 Bruckner Blvd., New York 61

Gasket Packing & Specialty Co., Inc. 45 N. Saxon Ave., Bay Shore

General Metals Corp., 444 S. 9th Ave. Mount Vernon

General Motors Corp., Brown-Lipe-Chapin Div., Town Line Rd., Syracuse

Gorton Die Casting Co., 55 S. 3rd Ave. Mt. Vernon

Gries Reproducer Corp., 125 Beechwood Ave., New Rochelle

Hamilton Die Casting Corp., 2020 Jericho Turnpike, New Hyde Park

Hydro Die Casting Corp., Sharon Ave. Plattsburg

Kasson Die & Motor Co., 34-08 Northern Blvd., Long Island City 1

Mark Kenny Products Co., Inc., 253 E. 137th St., New York

Kisiel Die Casting Works, 127 Otis St. Batavia

Long Island Die Casting, Inc., 21 Smith St. Inwood, L.I. 96

E. B. Metal Products Co., Inc., Box 149 Whitehall

National Casting Corp. 6517 14th Ave. Brooklyn

Oswego Castings Corp., Sub. of Oberdorfer Foundries, Inc., Box 222 Oswego

Rubor Tool & Die Co., 1819 Utica Ave. Brooklyn 34

Sargeant & Greenleaf, Inc., 24 Seneca Ave. Rochester 21

Seaboard Die Casting Co., 1125 Prospect Ave., West Islip, L.I.

Sharman Pressure Casting Co., 601 W. 26th St., New York 1

Skulsky Mfg. Co., 250 Moore St. Brooklyn 6

Star Casting Corp., 102 Prince St. New York 13

Staver Co., Inc., 41 N. Saxon St., Bay Shore, L.I.

Sterling Die Casting Co., Inc., 743 39th St. Brooklyn 32

Syracuse Die Casting & Mfg. Co., 2101 Teall Ave., E. Syracuse

Troy Die Casting Corp., 765 Elmont Rd. Elmont

David L. Wilkoff Co., Inc., 150 Broadway, New York 38

Wise Die Casting Corp., 98 Olean St. Rochester 8

World Metal Spinning Corp., Commercial St., Hicksville, L.I.

NORTH CAROLINA

Bassick-Sack Div., Stewart-Warner Corp., P.O. Box 4237, Winston-Salem

Carolina Foundry Co., Box 635, Charlotte

Dixie Die Casting Corp., P.O. Box 1208 Reidsville

OHIO

Akron Presform Mold Co., 2038 Main St. Cuyahoga Falls

Apex Die Casting Co., P.O. Box 8 Troy

Arro Expansion Bolt Co., P.O. Box 388, Marion

Arrow Aluminum Castings Co., 3135 Berea Rd., Cleveland 11

Atlas Die Casting Co., 362 N. Kelly Ave., Germantown

Basic Aluminum Castings Co., 1325 E 168th St., Cleveland 10

Cincinnati Die Casting Co., 2117 Spring Grove, Cincinnati 14

Conneaut Die Casting Co., 618 Sandusky St., Conneaut

Daniel Co., Edward W., 4050 St. Clair Ave. Cleveland 3

Dayton Die Casting Co., 111 Front St. Dayton 2

Die Cast Products Inc., 4040 Hough Ave. Cleveland 3

Di Salle Plating & Die Casting, Inc. 2851 S. Ave., Toledo

Doehler-Jarvis Div., National Lead Co., 1945 Smead Ave., Toledo 1

Robert H. Eggers Co., 4701 Perkins Ave., Cleveland 3

The Electric Autolite Co., Champlain St. Toledo

Empire Die Casting Co., 19800 Miles Ave. Cleveland 28

Fort Recovery Industries, Inc. Fort Recovery

Frantz Mfg. Co., 1200 Camden Ave., S.W. Canton 6

General Diecasters Inc., 6212 Akron Peninsula Rd., Peninsula

Halex Die Casting Co., 8640 Bessemer Ave. Cleveland 4

Hamilton Die Cast Co., 240 N. "B" St. Hamilton

Helfrich Die Casting Co., 207 Schneider Rd. North Canton

Hilfinger Corp., 1800 Westwood Ave. Toledo 7

Hoover Co., The, Die Cast Div. North Canton

Industrial Castings, Inc., 125 Willis St. Bedford

Kohler Corp., P.O. Box 104, Station B Cincinnati 22

Laco Die Casting Co., 23440 Lakeland Bl. Euclid 23

Lake Erie Industries, Inc., 26420 Lakeland Blvd., Euclid 32

Lester Castings, Inc., 25661 Cannon Rd. Bedford Hts.

Lewis & Son, Inc., Delaware Rd. Marysville

Lukens Aluminum Co., 746 Albany St., Dayton 8

Luster Corp., Cleveland Rd., Huron

Manor Die Cast Corp., P.O. Box 386 Bedford

Mohawk Foundry, Inc., 55 First St. Berea

Monarch Aluminum Mfg. Co., 9205 Detroit Ave., Cleveland 2

National Lead Co., 2100 Smead Ave., Toledo 1

Nelmor Mfg. Corp., 26420 Lakeland Blvd. Euclid

Ohio Die Casting Corp., 3083 Silver Dr., Columbus 14

Oren Products Co., 19950 Ingersoll Dr. Rocky River

Precision Castings Co., 12600 Berea Rd. Cleveland 11

Pressure Castings, Inc., 21500 St., Clair Ave. Cleveland 17

Schultz Die Casting Co., 1810-16 Clinton St. Toledo 7

Superior Die Casting Co., 1001 London Rd. Cleveland 10

Techni-Cast Corp., 600 Walnut St. Hamilton

Thompson-Ramo Wooldridge, Inc. Light Metals Div., 2269 Ashland Rd. Cleveland 3

Tool-Die Engineering Co., 3878 E. 93rd St., Cleveland 5

Weatherhead Co. Fort Wayne Div., Antwerp Plant Antwerp

Wells Mfg. Co. New Vienna

Westinghouse Electric Corp., 1216 W. 58th St., Cleveland

White Industries, Inc., 1325 E. 171 St. Cleveland 10

Yoder Die Casting, Inc., 727 Kiser St. Dayton 4

Yoder Industries, 1040 E. 1st St. Dayton 2

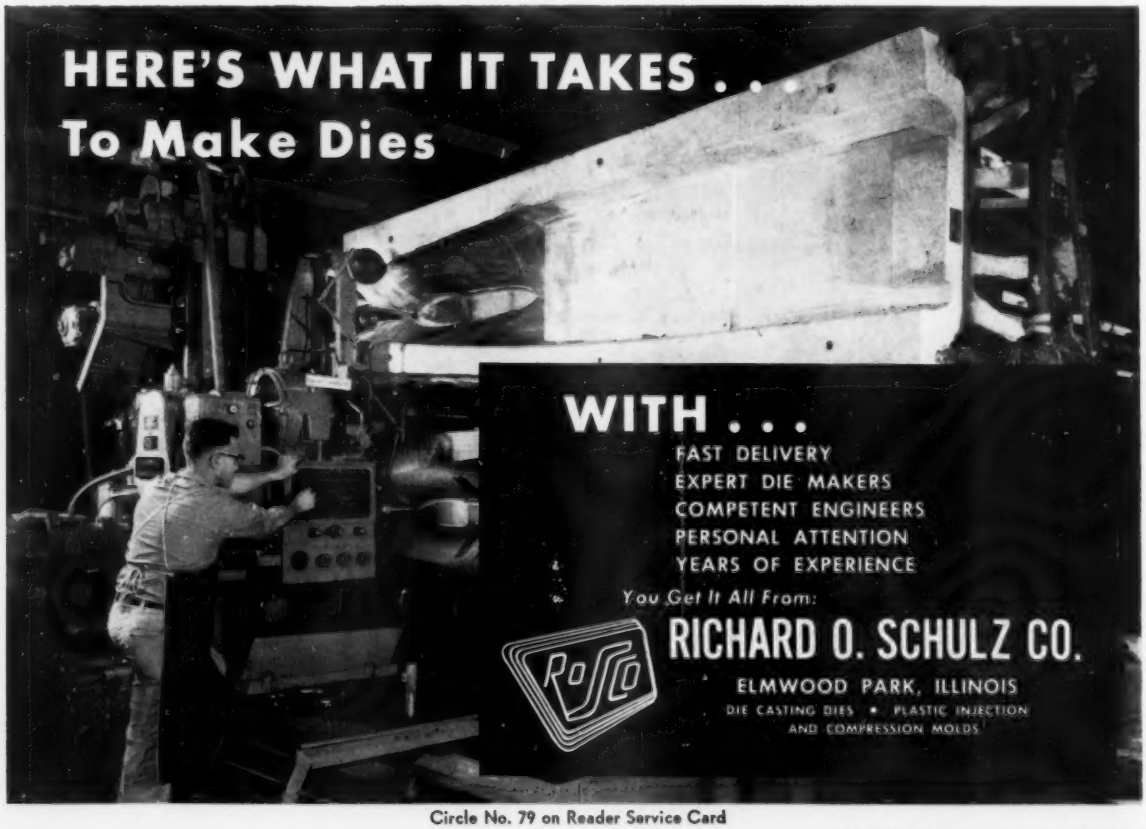
OKLAHOMA

Ajax Die Casting & Mfg. Co., 2002 E. 6th St., Tulsa

OREGON

A. J. Demoude Co., P.O. Box 392 Beaverton

Future Products Co., 3625 N. Mississippi Ave., Portland 17



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Irrigation Equipment Co., Inc., Industrial Div., 1300 Bethel Dr., Eugene

Kadee Metal Products Co., 720 S. Grape St. Medford

Nichols Tool & Die, 1831 N. Killingsworth Portland 17

Power Brake Equipment Co., 1632 S.E. 11th Ave., Portland 14

Product Engineering Co., 15227 S.E. Meadowbrook Lane., Milwaukee

Product Engineering Co., 4707 S.E. 17th Ave., Portland 2

PENNSYLVANIA

Aluminum Co. of America, Pittsburgh 19

Arlington Industries, Inc., 2 Dockash Pl., Scranton 3,

Auel Industries Herminie

Blue Ridge Pressure Casting, Inc., Bridge St. Lehigton

Bowersox Precision Castings Co., 3523 W. 9th St., Chester

John J. Carey Co., 2194-96 Bridge St. Philadelphia 24

Continental Metallifacture Co., 414 Pine St. Scranton

Eastern Non-Ferrous Foundries, Inc. 2811 Amber St., Philadelphia 34

Francis Co., A. W., Box 266 Somerset

General Cast Products, Inc., 2211 Waverly Ave., Swissvale

General Electric Co., Erie Foundries, Erie

Joseph Hall Co., 2121 W. Clearfield St. Philadelphia

Hamilton Machine Shop, 7829 Hamilton Ave. Pittsburgh 21

Hubley Manufacturing Co., Box 240 Lancaster

J & F Tool & Die Casting Corp., R.D. #2, P.O. Box 175, Athens

La France Precision Casting Co., 29th & McKean St., Philadelphia

Latrobe Die Casting Co., North & Unity Sts. Latrobe

Metro Casting Co., Inc., 40 Laurel Dr. Scranton 5

Parker White Metal Co., 2153 McKinley Ave. Erie

Pittsburgh Die & Casting Co., 7503 Ardmore St., Pittsburgh 18

Products Engineering & Mfg. Co., 569 Hulmeville Ave., Penndel

Reese Padlock Co., 128 Sherman St. Lancaster

Rockwell Corp., Pittsburgh Dubois Div., Main St., Sykesville

Super Grip Anchor Bolt Co., 3333 N. 22nd St., Philadelphia 40

U. S. Expansion Bolt Co. York

Wessel Hardware Corp., 919-931 N. Fifth St., Philadelphia

RHODE ISLAND

Crescent Co., 20 Central Ave., Pawtucket

Rhode Island Die Casting Co., 669 Elmwood Ave., Providence 7

TENNESSEE

Walker Metal Products, P.O. Box 315 Lewisburg

TEXAS

Dallas Die Casting Co., 334 Rock Island Dallas 7

Fort Worth Die Cast Co., Inc., 1213 E. Daggert, Fort Worth

Hall Level Mfg. Works, 1119 E. 4th St., Austin

R. W. Hughes Industries, Inc., 2713 Ludelle St., Fort Worth

Nichols Industries, Inc., P.O. Box 1191 Jacksonville

Proctor Metal Products, 629 Hill Ave., P.O. Box 1011, New Braunfels

Production Die Casting Co., 6502 Rusk Ave. Houston 11

Roberts Engineering & Mfg. Co., Inc., Box 4060, 640 Navigation Corpus Christi

J. Y. Taylor Mfg. Co., Box 529 Garland

WASHINGTON

Cosmopolitan Die Cast Products, 46 Etruria St., Seattle 9

Puget Casting Co., 2101 S. Mildred Tacoma 66

WISCONSIN

Acme Die Casting Corp., 1635 Murrary Ave. Racine

Advance Tool & Die Casting Co., 3760 N. Holten St., Milwaukee 12

Alliance Tool & Die Casting Corp., 2932 Burleigh, Milwaukee 10

Badger Die Casting Corp., 201 W. Oklahoma Ave., Milwaukee

Madison-Kipp Corp., 213 Waubesa St. Madison 4

Meta-Mold Aluminum Co., 525 E. Hamilton Rd., Cedarburg

Midwest Die Casting Co., 3930 N. First St. Milwaukee 12

Milwaukee Die Casting Co., 4132 N. Holton St., Milwaukee 12

Molnar Molds & Molding, 1358 Reservoir St., Pomona

Racine Die Casting Co., 1500 16th St. Racine

Scherer Die Casting Co., Alyce Ave. Cedarburg

J. W. Speaker Corp., 3059 N. Weil St. Milwaukee 12

Stroh Die Casting Co., Inc., 11123 W. Burleigh St., Milwaukee 10

CANADA

Automotive Accessory Co., Ltd., 1551 Erin St., Winnipeg, Manitoba

Barber Die Casting Co., Ltd., Box 416 Postal Stn. B., Hamilton, Ont.

Binkley Die Casting Co., Ltd., 175 Samuelson St., Galt, Ont.

Carpenter Die Casting Co., Ltd., 474 Burlington E., Hamilton, Ont.

Coulter Mfg. Co., Ltd., 28 Richmond St., W. Box 190, Oshawa, Ont.

Die Cast Products, Ltd., 1085 Winnipeg Ave., Winnipeg 3, Manitoba

Dominion Die Casting, Ltd., Libby St., Wallace Burg, Ont.

Dominion Lock Co., Ltd., 7301 Decarie Blvd, Montreal, Que.

Dunbar Aluminum Foundry Ltd., 315 Breithaupt St., Kitchener, Ont.

Fisher Gauge Works, Ltd. Peterborough, Ontario

Herlicon Metals & Plastics, Inc., 3815 Ruskin St., Montreal, Que.

Hoover Co., Ltd., The, Gage Ave., N. Hamilton, Ont.

Lakeshore Die Casting Co., Ltd., 482 Queen Elizabeth Way, E., Oakville, Ont.

Mendler Mfg. Co., Malden Rd., Sandwich Postal Sta., Windsor, Ont.

National Hardware Specialties, Ltd., Dresden, Ont.

Pressure Castings of Canada Ltd. 1777 Weston Rd., Weston, Ont.

Redl Industries Ltd., 2346 Clarke St., P.O. Box 105, Port Moody, B.C.

Richmond Machine Tool & Die Casting Co. Ltd., 5680 Fullum St., Montreal 36, Quebec

Schultz Die Casting of Canada, Ltd., 77 St. David St., Lindsay, Ontario

Terry Burners, Inc., 5105 Buchan St. Montreal, Que.

Webster Air Equipment Co., Ltd., 1161 King St., London, Ontario

White Die Casting Co., Mac Nab St. at Head, Dundas, Ontario

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Most hydraulic systems can be quickly and easily converted to fire-resistant UCON hydrolubes. Actual experience, in hundreds of industrial installations, shows that standard flushing and refilling procedures, involving a minimum of time and effort are sufficient.

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Cleveland Automatic Machine Co.
4932 Beech St., Cincinnati 12, Ohio

D.C.M.T. Sales Corp.
Div. of British Industries Corp.
80 Shore Rd., Port Washington, L.I., N.Y.

Joseph Dixon Crucible Co.
167 Wayne St., Jersey City 3, N.J.

International Foundry Supply Co.
P. O. Box 1053, Reading, Pa.

Vesuvius Crucible Co.
P.O. Box 8275, Pittsburgh 18, Pa.

DIE CASTABLE METALS

(Note: This listing of die castable metals includes suppliers of base ingot metal as well as suppliers of alloy.)

ALUMINUM

Alloys & Chemicals Corp.
4365 Bradley Rd. S.W., Cleveland, Ohio

Aluminum & Magnesium, Inc.
1 Huron St., Sandusky, Ohio

Aluminum Co. of America
Alcoa Bldg., Pittsburgh 19, Pa.

Aluminum Limited Sales, Inc.
630 Fifth Ave., New York 20, N.Y.

Aluminum Smelting & Refining Co., Inc.
5463 Dunham Rd., Maple Hts. 37, Ohio

American Alloys Corp.
45th & Belleview, Kansas City 11, Mo.

American Smelting & Refining Co.
Federated Metals Div.
120 Broadway, New York 5, N.Y.

Apex Smelting Co.
2537 W. Taylor Rd., Chicago 12, Ill.

Belmont Smelting & Refining Works, Inc.
307 Belmont Ave., Brooklyn 7, N.Y.

H. Cohn & Sons, Inc.
4528 W. Division St., Chicago 51, Ill.

Aaron Ferer & Sons, Inc.
2300 E. 11th St., Los Angeles, Calif.

General Smelting Co.
2901 E. Westmoreland St.,
Philadelphia 34, Pa.

Globoloy Metals, Inc.
1820 Tenth St., Oakland, Calif.

Henning Bros. & Smith, Inc.
91-113 Scott Ave., Brooklyn 6, N.Y.

International Foundry Supply Co.
P.O. Box 1053, Reading, Pa.

William F. Jobbins Co.
N. Lake Ave., Aurora, Ill.

Kaiser Aluminum & Chemical Corp.
Kaiser Center, Oakland, Calif.

Morris P. Kirk & Sons, Inc.
2700 S. Indiana, Los Angeles, Calif.

R. Lavin & Sons, Inc.
3426 S. Kedzie Ave., Chicago 23, Ill.

McGowan Co., Inc.
1205 S. Boyle Ave., Los Angeles, Calif.

Olin Mathieson Chemical Corp.
Aluminum Div.
400 Park Ave., New York, N.Y.

Projectile & Engineering Co., Ltd.
Acre St., Battersea, London S.W.,
England

Reynolds Metals Co.
6601 W. Broad St.
Richmond, Va.

Roth Smelting Co.
Thompson Rd., Syracuse, N.Y.

George Sall Metals Co., Inc.
2300 East Butler St., Philadelphia 37, Pa.

Sonken-Galamba Corp.
Riverview at 2nd St., Kansas City 18,
Kans.

U.S. Reduction Co.
Melville & Chicago Aves., E. Chicago, Ind.

Hyman Viener & Sons
Viener Metals
P.O. Box 573, Richmond 5, Va.

Wabash Smelting, Inc.
P.O. Box 242, Wabash, Ind.

BRASS

American Smelting & Refining Co.
Federated Metals Div.
120 Broadway, New York 5, N.Y.

Belmont Smelting & Refining Works, Inc.
307 Belmont Ave., Brooklyn 7, N.Y.

Henning Bros. & Smith, Inc.
91-113 Scott Ave., Brooklyn 6, N.Y.

R. Lavin & Sons, Inc.
3426 S. Kedzie Ave., Chicago 23, Ill.

Projectile & Engineering Co., Ltd.
Acre St., Battersea, London S.W.,
England

George Sall Metals Co., Inc.
2300 E. Butler St., Philadelphia 37, Pa.

Sonken-Galamba Corp.
Riverview at 2nd St., Kansas City 18,
Kans.

Hyman Viener & Sons
Viener Metals
P.O. Box 573, Richmond 5, Va.

BRONZE

Henning Bros. & Smith, Inc.
91-113 Scott Ave., Brooklyn 6, N.Y.

Hyman Viener & Sons
Viener Metals
P.O. Box 573, Richmond 5, Va.

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Hyman Viener & Sons
Viener Metals
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Federated Metals Div.
120 Broadway, New York 5, N.Y.

Belmont Smelting & Refining Works, Inc.
307 Belmont Ave., Brooklyn 7, N.Y.

Bunker Hill Co.
660 Market St., San Francisco, Calif.

Henning Bros. & Smith, Inc.
91-113 Scott Ave., Brooklyn 6, N.Y.

Indussa Corp.
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R. Lavin & Sons, Inc.
3426 S. Kedzie Ave., Chicago 23, Ill.

National Lead Co.
111 Broadway Ave., New York, N.Y.

Projectile & Engineering Co., Ltd.
Acre St., Battersea, London S.W.,
England

Roth Smelting Co.
Thompson Rd., Syracuse, N.Y.

George Sall Metals Co., Inc.
2300 East Butler St., Philadelphia 37, Pa.

Sonken-Galamba Corp.
Riverview at 2nd St., Kansas City 18,
Kans.

Hyman Viener & Sons
Viener Metals
P.O. Box 573, Richmond 5, Va.

MAGNESIUM

Aluminum & Magnesium, Inc.
1 Huron St., Sandusky, Ohio

Apex Smelting Co.
2537 W. Taylor Rd., Chicago 12, Ill.

Belmont Smelting & Refining Works, Inc.
307 Belmont St., Brooklyn 7, N.Y.

Dow Chemical Co.
Midland, Mich.

TIN

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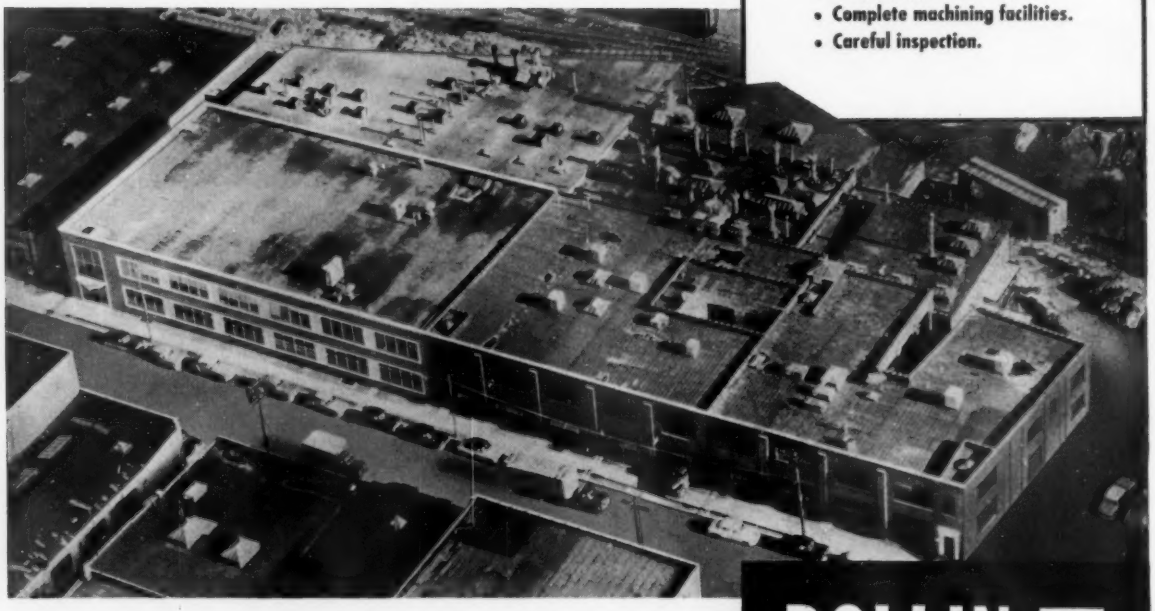

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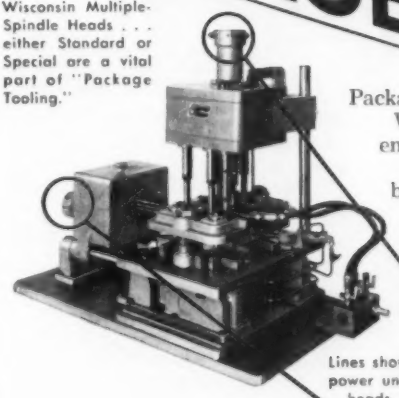

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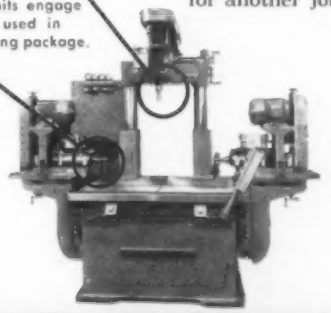

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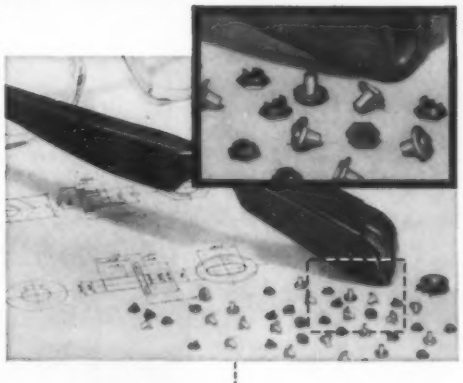

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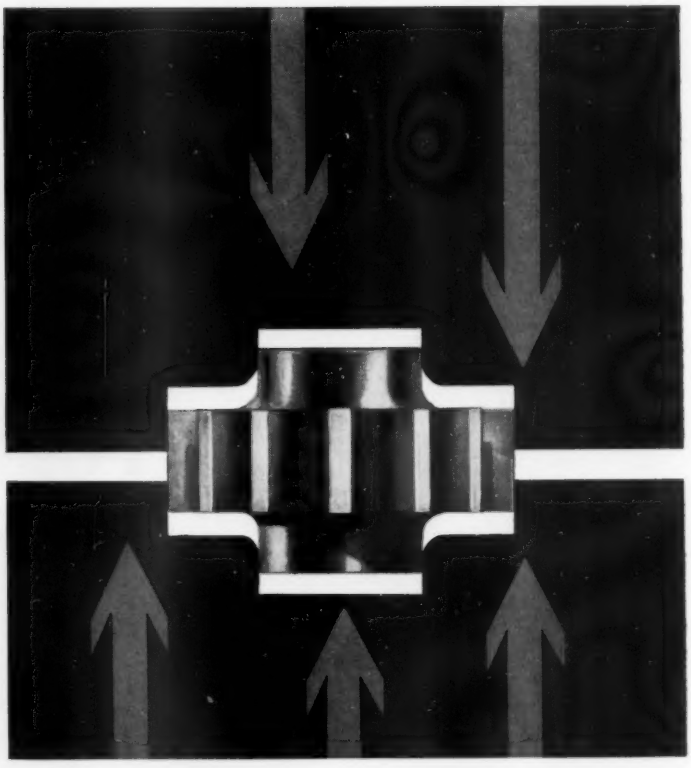

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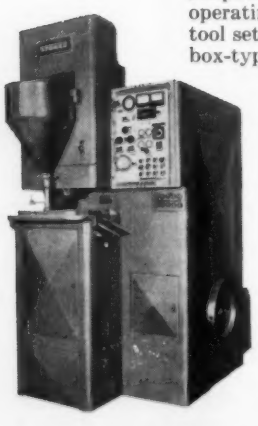

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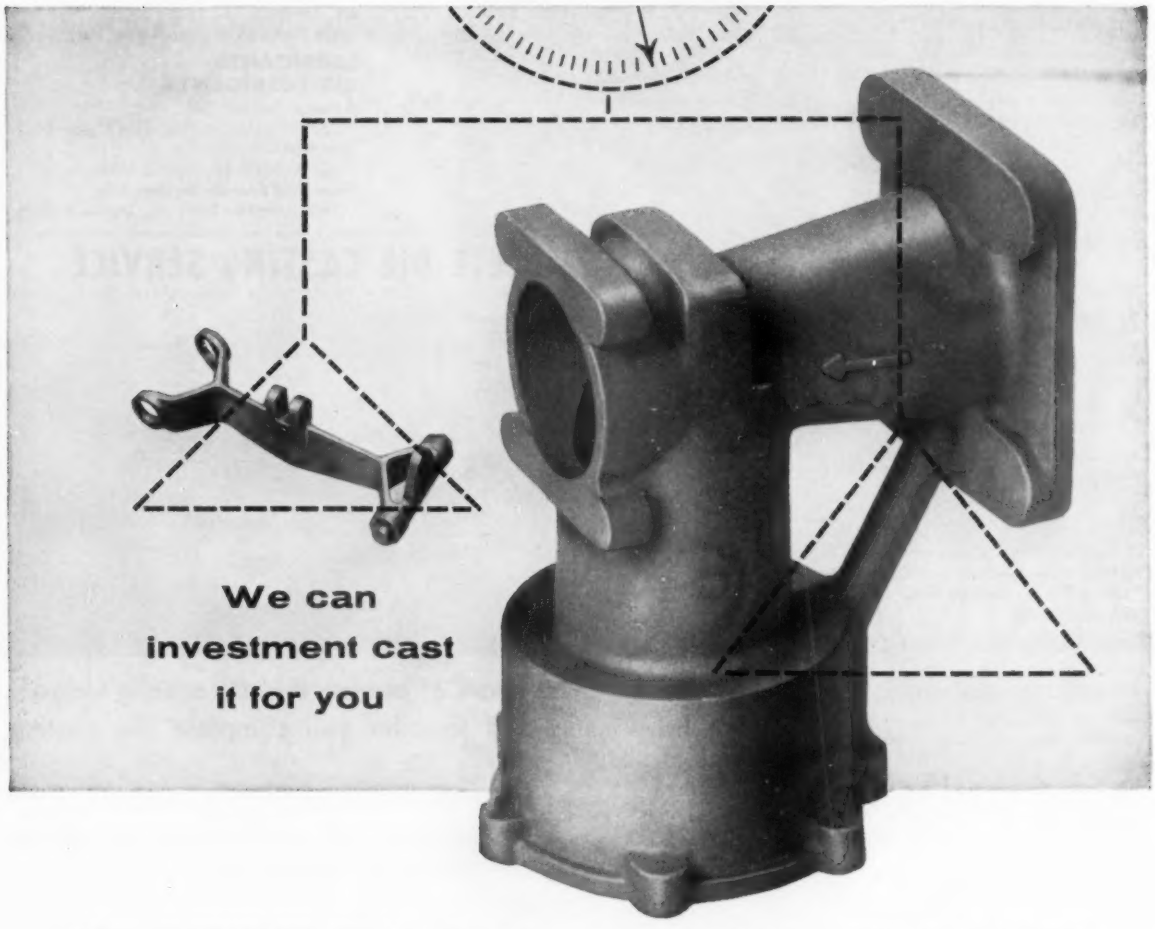

Today, no matter how large the part on your drawing board . . . whether it weighs a few ounces or as much as 100 pounds . . . Arwood can investment cast it. It makes no difference what the metal or alloy is. We cast all castable materials, ferrous and non-ferrous, including magnesium. So now you can reap the benefits of investment casting in the broadest range of part sizes, weights and materials ever. Benefits like freedom to specify the best possible metal for the job . . . sharply reduced production costs on complex shapes . . . quick, inexpensive tooling in design development work.

Add to these the advantage of having a single casting source for *all* your investment cast parts, both large and small.

Our five foundries can give you the metal you need, the shape you need, and the quantity you need, from a few design prototypes to many thousands.

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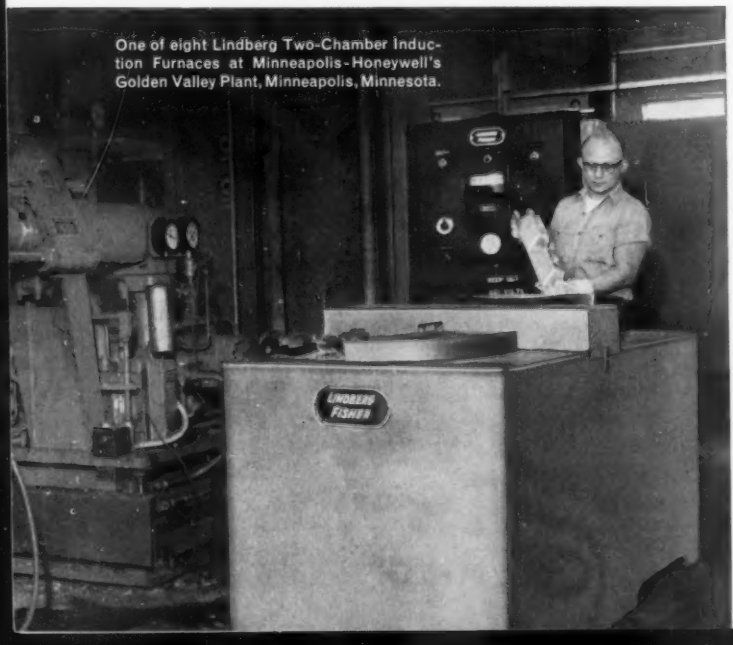
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

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heat for industry

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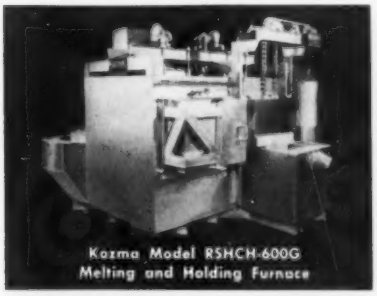
THE PERFECT PAIR FOR DIE CASTING

A Kozma Melting and Holding Furnace, in combination with the revolutionary, new Kozma Automatic Ladle, delivers highest quality metal . . . at lowest possible cost.

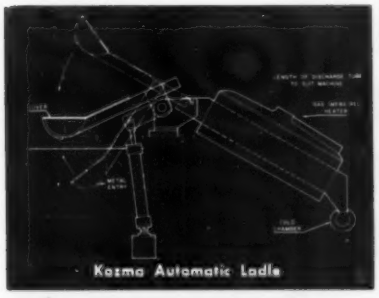


Kozma Model RSHCH-600G
Melting and Holding Furnace

Exclusive Kozma "Pre-Temp" charging and sub-surface metal flow practically eliminates oxygen and hydrogen pick-up and oxide inclusions, keeping metal at high purity level.

Radiant firing provides faster, more uniform heat distribution, eliminates flame impingement and reduces fuel costs.

Kozma Model RSHCH Furnaces range in capacity from 300 to 2,000 lbs. per hour with design variations to meet your requirements.



Kozma Automatic Ladle

The Kozma Automatic Ladle is fast . . . dependable . . . low cost . . . with ½ ounce "shot-to-shot" accuracy. Bottom entry and cover provide sub-surface fill to assure delivery of clean metal to the cold chamber. Will deliver accurately up to 300 shots per hour.

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Another

TRUE CASE HISTORY

taken from the secret files of **AFSCO's** Inspector at Large, Dr. Ox-Ides.

The Problem:

A nationally known extruding firm was interested in used aluminum cans as a scrap source.

Melting had to be done in a 50,000 lb. reverberatory furnace. The cans were briquetted and 20,000 lbs. of cans were charged in each heat.

The metal thus produced met with customer's specifications; however, they experienced an excessive amount of dross which was rich in contained metallics and extremely difficult to remove from the furnace due to the large congealed lumps of dross. The metal loss for each trial heat averaged 25%. This loss, combined with excessive labor costs, obviously precluded the use of these cans as a continuing scrap source, unless an economical remedy could be found.

THE SOLUTION —

Upon examination by our technical staff it was determined that existing fluxing and degassing techniques would have to be drastically revised.

Our staff attacked the problem and in five days a new flux compound was developed that reduced the hard-to-remove dross to a fine powder, very low in contained metallics.

Metal loss reduced 200% and where formerly each heat required 5 hours for fluxing and degassing, this function is now being satisfactorily done in one hour's time. A very substantial saving of time and money, allowing the customer to continue with aluminum cans as a primary scrap source.

This is just one example of our service. Our laboratory and technical staff are at your service with no charge or obligation.

The AFSCO Range of metal casting aids for die casters, permanent mold, sand foundries, extruders, and smelters include smokeless, non-fuming fluxes for:

● Aluminum ● Zinc ● Brass ● Tin ● Lead ● Solder ● Antimonial Metals ● Degassers for Aluminum Alloys and Brass.

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(Some areas open for distribution. Write for full particulars.)

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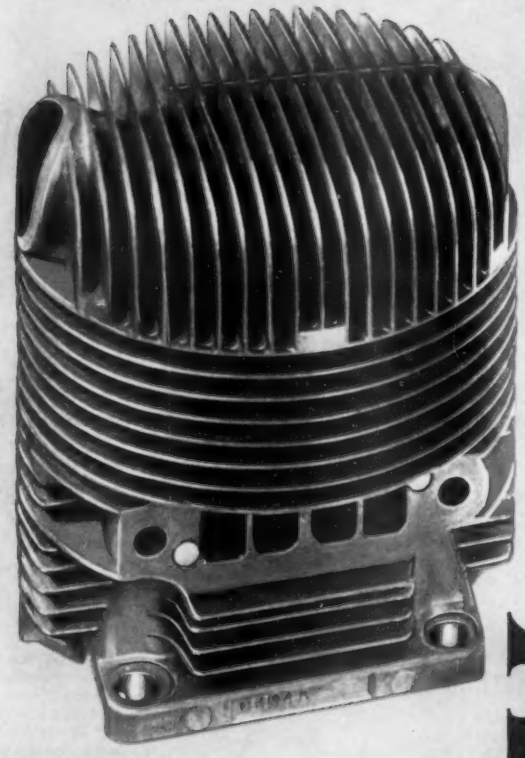

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Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

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Richmond Hills, L.I., N.Y.

Lea Mfg. Co.
16 Cherry Ave., Waterbury, Conn.

Merit Products, Inc.
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Norton Co.
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Ransohoff Co.
North 5th St. at Ford, Hamilton, Ohio

Schaffner Mfg. Co., Inc., Schaffner
Center, Emsworth 2, Pa.

Frederic B. Stevens, Inc.
1800 Eighteenth St., Detroit 16, Mich.

CHEMICAL CONVERSION COATING EQUIPMENT

Allied Research Products, Inc.
4004 E. Monument St., Baltimore 5, Md.

Conversion Chemical Corp.
98 E. Main St., Rockville, Conn.

Enthone, Inc.
Div. of American Smelting & Refining Co.
442 Elm St., New Haven 2, Conn.

Hanson-Van Winkle-Munning Co., 100
Church St., Matawan, N.J.

Metal & Thermit Corp.
P. O. Box 471, Rahway, N.J.

Metalwash Machinery Co.
901 North Ave., Elizabeth, N.J.

CHEMICAL CONVERSION COATING SUPPLIES

Allied Research Products, Inc.
4004 E. Monument St., Baltimore 5, Md.

Amchem Products, Inc.
Ambler, Pa.

American Smelting & Refining Co.
Federated Metal Div.
120 Broadway, New York 5, N.Y.

Conversion Chemical Corp.
98 E. Main St., Rockville, Conn.

Cowles Chemical Co.
Promat Div.
851 Market St., Waukegan, Ill.

Diversey Corp.
212 W. Monroe, Chicago 6, Ill.

Enthone, Inc.
Div. of American Smelting & Refining Co.
442 Elm St., New Haven 2, Conn.

Frederick Gumm Chemical Co.
538 Forest St., Kearny, N.J.

Hanson-Van Winkle-Munning Co., 100
Church St., Matawan, N.J.

Heatbath Corp.
Indian Orchard, Mass.

Hubbard Hall Chemical Co.
8 Benedict St., Waterbury, Conn.

MacDermid, Inc.
526 Huntingden St., Waterbury, Conn.

Magnuson Products Corp.
50 Court St., Brooklyn, N.Y.

Metal & Thermit Corp.
P. O. Box 471, Rahway, N.J.

Neilson Chemical Co.
2300 Gainsboro, Detroit 20, Mich.

Northwest Chemical Co.
9310 Roselawn Ave., Detroit, Mich.

Oakite Products, Inc.
19 Rector St., New York 6, N.Y.

Ransohoff Co.
North 5th St. at Ford, Hamilton, Ohio

Rutley Industries, Inc.
265 Butler St., Brooklyn 17, N.Y.

Speed-D-Burr Corp.
231 E. Lomita, Wilmington, Calif.

Turco Products, Inc.
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Turco Products, Inc.
Metal Processes Div.
Joliet, Ill.

CLEANING EQUIPMENT

Allied Research Products, Inc.
4004 E. Monument St., Baltimore 5, Md.

Almco Queen Products Div.
King Seeley Corp., Albert Lea, Minn.

Alsop Engineering
1003 Fine St., Milldale, Conn.

B.M.T. Mfg. Corp.
110 E. Ninth St, Elmira Hts., N.Y.

Branson Ultrasonic Corp.
37 Brown House Rd., Stamford, Conn.

Conforming Matrix Corp., 830 New York
Ave., Toledo 11, Ohio

Enthone, Inc.
Div. of American Smelting & Refining Co.
442 Elm St., New Haven 2, Conn.

Frederick Gumm Chemical Co.
538 Forest St., Kearny, N.J.

Hanson-Van Winkle-Munning Co., 100
Church St., Matawan, N.J.

Hubbard Hall Chemical Co.
8 Benedict St., Waterbury, Conn.

Lord Chemical Corp.
Sub. of Wheelabrator Corp.
2068 So. Queen St., York, Pa.

Metalwash Machinery Co.
901 North Ave., Elizabeth, N.J.

Narda Ultrasonic Corp.
625 Main St., Westbury, L.I., N.Y.

New Holland Machine Co.
New Holland, Pa.

Pangborn Corp.
10 Pangborn Blvd., Hagerstown, Md.

Ransohoff Co.
North 5th St. at Ford, Hamilton, Ohio

Roto-Finish Co.
3700 Milham Rd., Kalamazoo, Mich.

Speed-D-Burr Corp.
231 E. Lomita, Wilmington, Calif.

Frederic B. Stevens, Inc.
1800 Eighteenth St., Detroit 16, Mich.

Turco Products, Inc.
24600 S. Main St., Wilmington, Calif.

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1651 E. Grand Blvd., Detroit 11, Mich.

Wheelabrator Corp.
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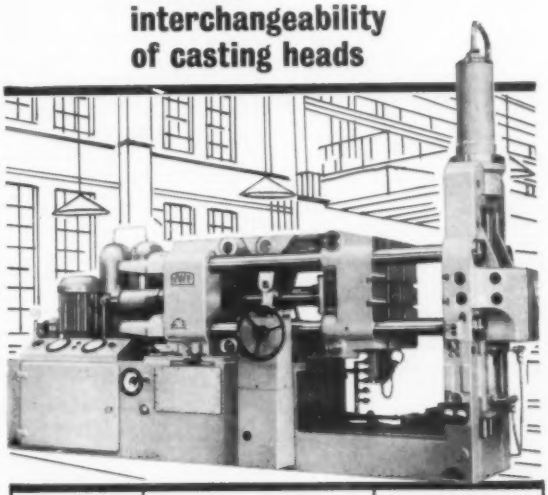

TYPE	NOMINAL LOCKING PRESSURE (Metric Tons)	MAXIMUM LOCKING PRESSURE (Tons)
DMK/50	50	75
DMK/100	100	150
DMK/200	200	300
DMK/400	400	600
DMKh/630	630	800
DMKh/800	800	1200

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Enthone, Inc.
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Hanson-Van Winkle-Munning Co., 100
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Hubbard Hall Chemical Co.
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Lea Mfg. Co.
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MacDermid, Inc.
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Metalwash Machinery Co.
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Frederick Gumm Chemical Co.
538 Forest St., Kearny, N.J.

Hanson-Van Winkle-Munning Co., 100
Church St., Matawan, N.J.

Hubbard Hall Chemical Co.
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Lea Mfg. Co.
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Conversion Chemical Corp.
98 E. Main St., Rockville, Conn.

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851 Market St., Waukegan, Ill.

Diversey Corp.
212 W. Monroe, Chicago 6, Ill.

Enthone, Inc.
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Heatbath Corp.
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Hubbard Hall Chemical Co.
8 Benedict St., Waterbury, Conn.

Lea Mfg. Co.
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Mecha-Finish Corp.
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Boice-Crane Co.
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Buhr Machine Tool Co.
825 Green, Ann Arbor, Mich.

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Atlas Press Co.
2073 N. Pitcher, Kalamazoo, Mich.

Delta Power Tool Div.
Rockwell Manufacturing Co.
400 N. Lexington Ave., Pittsburgh 8, Pa.

Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Edlund Machinery Co.
Div. of Harsco Corp.
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Hamilton Tool Co., The
Hamilton, Ohio

Johnson Drill Head Co.
23rd Ave. & 20th, Rockford, Ill.

Leland-Gifford Co.
1001 Southbridge St., Worcester, Mass.

National Automatic Tool Co., Inc.
7th & "N" Sts., Richmond, Ind.

Olivetti Machine Tools
42-33 Northern Blvd.
Long Island City 1, N.Y.

Portomag Corp.
1511 E. 9 Mile Rd., Ferndale, Mich.

R & B Machine Tool Co.
118 E. Michigan Ave., Saline, Mich.

B. M. Root Co.
420 S. Sherman St., York, Pa.

Sigourney Tool Co.
P. O. Box 2310, Hartford 1, Conn.

Walker-Turner Div.
Rockwell Mfg. Co.
Dept. 44-N Lexington Ave., Pittsbrugh, Pa.

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200 Central Ave., Hawthorne, N.J.

Barnes Drill Co.
818 Chestnut, Rockford, Ill.

Beckett-Harcum Co., Inc.
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Boice-Crane Co.
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Buhr Machine Tool Co.
825 Green, Ann Arbor, Mich.

Clausing Div.
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Commander Mfg. Co.
4233 W. Kinzie, Chicago, Ill.

Delta Power Tool Div.
Rockwell Manufacturing Co.
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Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Drillunit, Inc.
3267 Wight, Detroit, Mich.

Dumore Co., The
1323 Seventeenth, Racine, Wis.

Duro Metal Products Co.
2695 Kildare Ave., Chicago, Ill.

Errington Mechanical Lab., Inc.
16 Norwood Ave., Staten Island, N.Y.

Ettco Tool & Machine Co., Inc.
588-602 Johnson Ave., Brooklyn, N.Y.

Gotha, Inc.
Box 430-T, Harvey, Ill.

Greenlee Bros. & Co.
Rockford, Illinois

Hole Engineering Services
Box 4877, Detroit 19, Mich.

Johnson Drill Head Co.
23rd Ave. & 20th, Rockford, Ill.

Kingsbury Machine Tool Corp.
66 Laurel, Keene, N.H.

F. Jos. Lamb Co.
5663 E. 9 Mile Rd., Detroit 34, Mich.

National Automatic Tool Co., Inc.
7th & "N" Sts., Richmond, Ind.

Precise Products Corp.
3715 Blue River Rd., Racine, Wis.

R & B Machine Tool Co.
118 E. Michigan Ave., Saline, Mich.

B. M. Root Co.
420 S. Sherman St., York, Pa.

Thriftmaster Products Corp.
1042E N. Plum, Lancaster, Pa.

Universal-Automatic Corp.
9545-T Ainslie, Schiller Park, Ill.

Walker-Turner Div.
Rockwell Mfg. Co.
Dept. 44-N. Lexington Ave.
Pittsburgh, Pa.

Wisconsin Drill Head Co.
4989 N. 124th, Butler, Wisc.

DRILLING UNITS (Misc.)

Bodine Corp.
317 Mt. Grove St., Bridgeport 5, Conn.

Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Govro-Nelson Co.
1933 Antoinette, Detroit, Mich

Hartford Special Machinery Co.
College Highway, Simsbury, Conn.

Geo. A. Terry Co.
360 S. Elmwood Ave., Buffalo, N.Y.

ELECTRICAL DISCHARGE MACHINES

Easco Products, Inc.
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Atlas Press Co.
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Drillunit, Inc.
3267 Wight, Detroit, Mich.

Gotha, Inc.
Box 430-T, Harvey, Ill.

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Syracuse Special Machinery
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Alkon Products Corp.
200 Central Ave., Hawthorne, N.J.

Barnes Drill Co.
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Beckett-Harcum Co., Inc.
975 W. Locust, Wilmington, Ohio

Buhr Machine Tool Co.
825 Green, Ann Arbor, Mich.

Commander Mfg. Co.
4233 W. Kinzie, Chicago, Ill.

Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Drillunit, Inc.
3267 Wight, Detroit, Mich.

Dumore Co., The
1323 Seventeenth, Racine, Wis.

Errington Mechanical Lab., Inc.
16 Norwood Ave., Staten Island, N.Y.

Ettco Tool & Machine Co., Inc.
588-602 Johnson Ave., Brooklyn, N.Y.

Greenlee Bros. & Co.
Rockford, Illinois

Hole Engineering Services
Box 4877, Detroit 19, Mich.

Johnson Drill Head Co.
23rd Ave. & 20th, Rockford, Ill.

Kingsbury Machine Tool Corp.
66 Laurel, Keene, N.H.

F. Jos. Lamb Co.
5663 E. 9 Mile Rd., Detroit 34, Mich.

National Automatic Tool Co., Inc.
7th & "N" Sts., Richmond, Ind.

R & B Machine Tool Co.
118 E. Michigan Ave., Saline, Mich.

Thriftmaster Products Corp.
1042E N. Plum, Lancaster, Pa.

Universal-Automatic Corp.
9545-T Ainslie, Schiller Park, Ill.

Wisconsin Drill Head Co.
4989 N. 124th, Butler, Wisc.

TAPPING MACHINES

Bodine Corp.
317 Mt. Grove St., Bridgeport 5, Conn.

Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Hamilton Tool Co., The
Hamilton, Ohio

Leland-Gifford Co.
1001 Southbridge St., Worcester, Mass.

Wisconsin Drill Head Co.
4989 N. 124th, Butler, Wisc.

TAPPING UNITS (Misc.)

Bodine Corp.
317 Mt. Grove St., Bridgeport 5, Conn.

Drillmation Co.
6507 E. 11 Mile Rd., Centerline, Mich.

Govro-Nelson Co.
1933 Antoinette, Detroit, Mich.

Hartford Special Machinery Co.
College Highway, Simsbury, Conn.

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Gus Kusy Die Casting Co., 1834 N. Keystone, Burbank

Molnar Molds & Molding, 1358 S. Reservoir St., Pomona

Paragon Tool Die & Engineering, 11035 Sutter Ave., Pacoima

Setco, Inc., 10410 Pearmain St., Oakland

W. L. Stockwell-Molds, 3051 Verdugo Rd. Los Angeles

ILLINOIS

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Anderson Tool & Mfg. Co., 3450 N. Kostner Ave., Chicago

Atols Tool & Mold Corp., 5005 W. Armitage Ave., Chicago (Die Casting Dies)

Chicago Mold Engineering Co., Inc., 4141 Washington Blvd., Hillside

Comet Die & Engraving, 1150 N. Cicero Ave., Chicago

Custom Die Mold, 2708 W. Belmont Ave. Chicago

Damen Tool & Engineering Co., Inc., 4621-27 N. Olcott Ave., Harwood Hts. (Die Casting Dies)

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Domeny Tool & Stamping Co., 1331 W. Bellmont, Chicago

Dot-Lee Tool & Engineering Co., 2031 N. Parkside Ave., Chicago

Federal Tool Corp., 3600 W. Pratt Blvd. Chicago

Gregg Development & Engineering, 2419 W. 14th St., Chicago

Huml Bros., 1530-36 Mannheim Rd. Stone Park

Industrial Precision Products, 325 N. Hoyne Ave., Chicago

Ken Die & Tool, 1285 Golf Rd., Des Plaines

Metalmasters, Inc., 5725 N. Ravenswood Ave., Chicago

Midland Die & Engraving Co., 502 Factory Rd., Addison Rd., Addison

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Rockford Crescent Mfg. Co., 420 Buckbee St., Rockford

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John E. Skach Tool Co., 1511 Mannheim Rd., Stone Park

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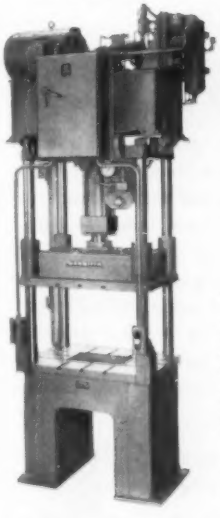

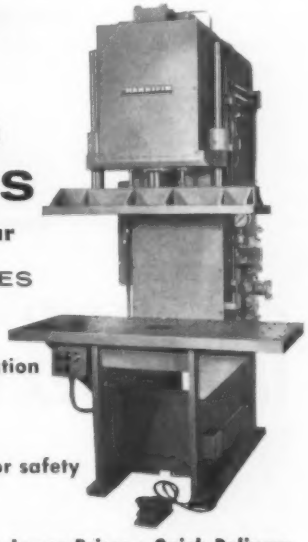

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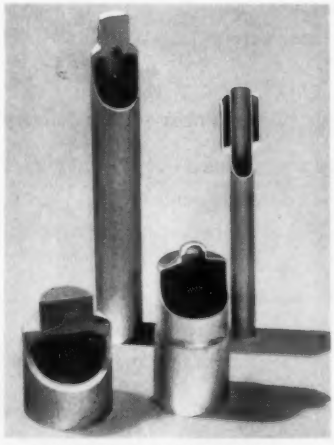

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LOWER COST CRUCIBLES

. . . for indirect arc melting

By R. V. LAMAIRE

IN THE INVESTMENT CASTING INDUSTRY wide use is made of small indirect arc furnaces for the melting of individual investment mold metal charges. Usually the furnace crucibles (Fig. 1) are purchased. They are two piece assemblies; that is, pressed top and bottom halves cemented together. This method produces crucibles which have high rates of erosion and physical breakdown at the bond line. It is desirable to have crucibles which are monolithic structures. Other considerations are the cost of supplied crucibles and the attendant cost of rebuilding arc furnace shells. A major portion of arc furnace costs is the rebuilding operation. The backup insulating refractories are removed. The burnt out crucible is removed, and a new one set in place and reinsulated. Any extension in the useful service life of a crucible would cut down on the number of rebuilding operations, thus reducing overall costs.

If crucibles are to be in-plant produced, it has to be done with utmost simplicity and low cost.

A very satisfactory method for producing monolithic crucibles uses a variation of the lost-wax process. A castable refractory is poured around a wax shape; after the refractory hardens the wax is removed. The cavity forms the melting chamber in a seamless refractory crucible.

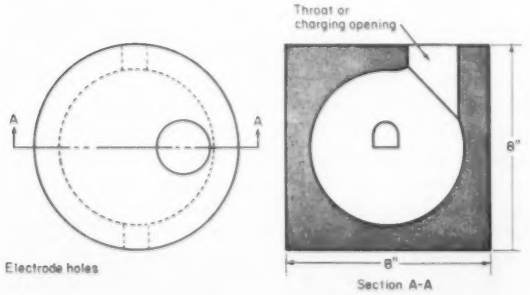


FIGURE 1 MELTING CRUCIBLE with a 10 lb. capacity has a 6" spherical melting chamber.

Production of crucibles is done using standard mixing and furnace equipment available in most investment casting foundries. The molds necessary for the casting of the cavity shape in wax and the crucible casting mold are quite simple and once made are good for many years. Without sacrificing crucible quality, costs are reduced 40% to 50%. Production experience on over 100 crucibles made from a high alumina castable refractory melting iron base alloys showed a 10% increase in service life and a good resistance to thermal shock, cracking, and slag penetration.

PROCEDURE

For illustration, the procedure will be confined to the 10 lb. capacity melting crucible. This is an 8" diameter by 8" tall cylinder with a 6" spherical melting chamber (Fig. 1) The first step in the production of a crucible is to make a wax shape which will form the melting cavity. A two piece aluminum mold similar in appearance to the actual crucible serves as a wax mold. This mold is filled with molten wax (scrap pattern wax was used with excellent results) and allowed to set until a 3/16"–1/4" wall is solidified. The excess liquid wax is then drained from the mold. After further cooling the mold is opened and the wax pattern removed. The wax mold is designed for an extra inch of wax cast on each of the electrode sections and also on the throat of charging opening. The extra stock on these three sections is used to position the wax ball properly in the refractory casting mold. The refractory casting mold is shown in Fig. 2. It consists of two sides and a base plate. The separate parts of the mold are pinned to insure proper alignment. The inside of the mold is lightly coated with motor oil as a parting medium, and the wax pattern secured in the casting mold by melting back some of the extra wax on the electrode opening to seal it to the outside of the mold.

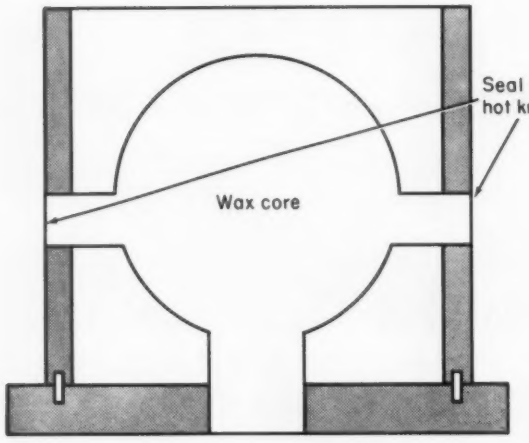


FIGURE 2 REFRACTORY CASTING MOLD consists of two sides and a base plate with pins to insure proper alignment.

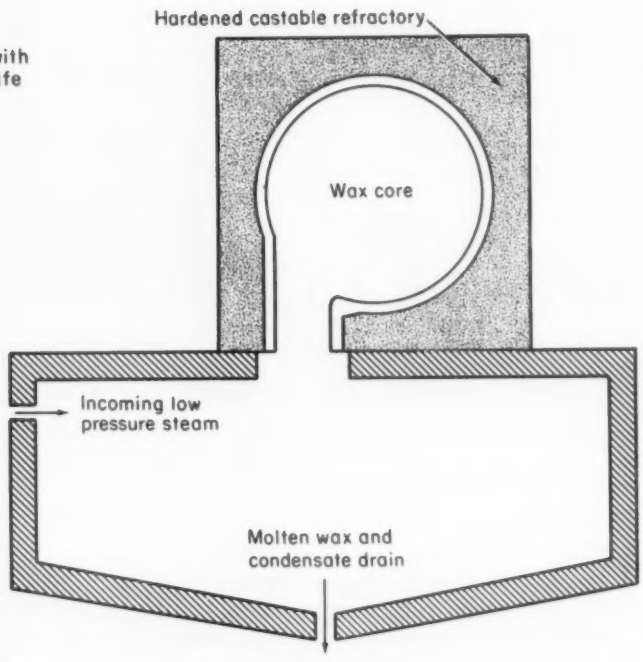


FIGURE 3 STEAM DEWAXING TABLE is used to remove the wax pattern from the refractory casting mold.

The castable refractory is mixed with a minimum amount of water and the mold filled. Rodding and vibration of the castable helps to remove entrained air and to assure complete filling of the mold. Vibration should continue for very few minutes after filling as excessive vibration will tend to produce segregation of the grog portion of the castable refractory. This would give variable density in the crucible. The filled mold is covered with damp rags and then a piece of plastic to prevent undue loss of moisture until the hydraulic bonding action is complete. For best results the crucible is left in the mold for 48 hours, the coverings and the form are then removed and the crucible is placed on a steam dewaxing table (Fig. 3) for removal of the wax pattern. Since wax is a very poor heat conductor, the inside wax surface, heated by the steam, melts and flows down and out of the crucible before much expansion occurs. By keeping the wax from expanding, minimum thermal expansion stresses, tending to produce cracking, are placed on the green crucible.

After the dewaxing operation the crucible can be cooled to room temperature and stored for later firing or can be immediately transferred to another furnace for firing. The crucibles may be fired in the same furnace with investment molds. This completely burns out any remaining volatile matter and gives the crucible sufficient strength to withstand the normal handling in rebuilding an arc furnace shell.

Experience has been limited so far to a commercial calcium aluminate bonded alumina refractory. The particle sizes range from 4 mesh to fines, and the material has a nominal 96.5% alumina content. These crucibles are satisfactory for melting most common nickel, cobalt and iron base alloys. On iron base alloys the average life for 100 crucibles was 51 heats per crucible compared to a 45 heat average life for one lot of 77 magnesia-alumina crucibles purchased from a commercial source.

The cast crucibles showed very good thermal shock resistance; several crucibles were fired at high temperature (2800-3000°F.) to increase the strength and decrease the porosity. Both of these objectives were realized, but there was also a sharp decrease in thermal shock resistance. This made high firing impractical. The best results were obtained by firing the crucibles to normal investment mold burnout temperature (1500-1800°F.). One very definite advantage of this method of crucible manufacture is the ease and low cost of modifying either crucible size or melting cavity design. In most cases a hand fashioned wax pattern will serve very nicely until a size or design is worked out. The majority of the crucibles made have been 10 to 15 pound capacity. Limited experience has shown good results in both 25 and 50 pound sizes.

PMM

book review

METALLIZING HANDBOOK, H.S. Ingham and A.P. Shepard; Metallizing Engineering Co., Inc., Westbury, N.Y. 1959. 320 pages.

• • •

This is the seventh edition of a basic text on the metallizing process. New subjects covered are the ThermoSpray process, an entirely new spraying method, and Spray-welding, the process of spraying and fusing a coating. Since metallizing has advanced to include the spraying of ceramic materials, the process is now referred to more generally as flame spraying (PMM Oct. 60, p. 118).

In addition to the new processes, the book covers the important advances in the basic wire metallizing process. Extensive technical data on the physical and mechanical properties of the coatings and application procedures is included.

COATED ABRASIVES—MODERN TOOL OF INDUSTRY, Coated Abrasives Manufacturers' Institute; McGraw-Hill Book Co., Inc., New York, 1958. 426 pages. Price: $8.50.

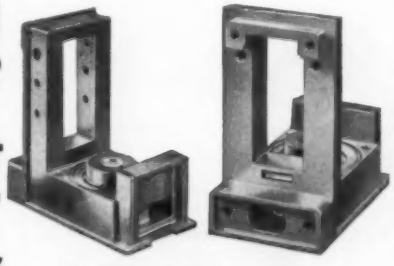
• • •

The authors intended that this book help manufacturers decide what operations in their plants may be done better with coated abrasives. To accomplish this, they have compiled a comprehensive guide to the use of this material in industry.

The book covers the nature, advantages, applications, and efficient utilization of coated abrasives. Many specific cases illustrate the economical and efficient use of the material. Recent advances in the field, such as automatic machinery, strip scouring, pre-plate finishing, and contour finishing are discussed. Separate chapters tell how to deal with each specific material.

There are sections on cutting oils, coolants, and lubricants made specifically for use with coated abrasives.

Dimensional Accuracy? YES... but Other 'Specs' are Equally Exacting!



Two views of zinc die-cast body for Air Controlled Timing Valve.

In addition to exacting dimensional tolerances, users of die castings often require other equally precise specifications to be met. For example, in the zinc die-cast body for the Air Controlled Timing Valve pictured, the following requirements were specified to insure successful assembly and functioning: absolute *solidity* and *high density* of the zinc alloy to prevent air leakage — along with a cast-in diaphragm surface absolutely smooth and free from imperfections; bottom of rectangular hole free from burrs; all plane surfaces flat and either parallel or square to one another.

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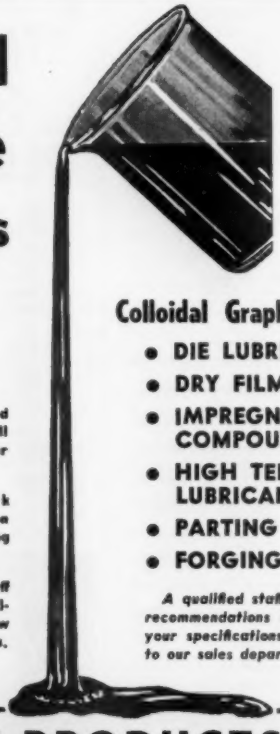

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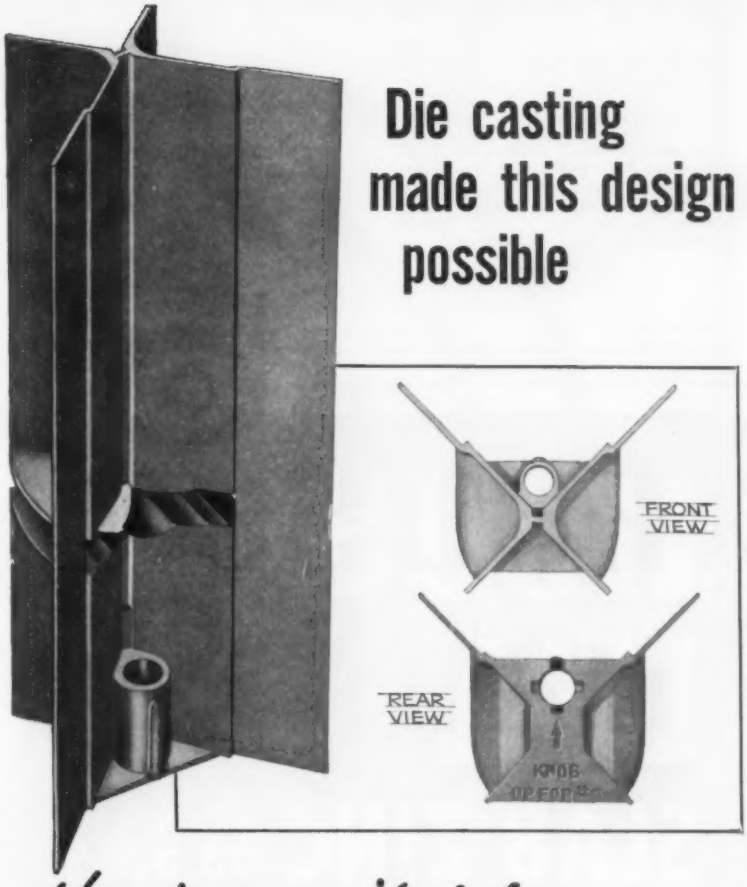

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Twin City's ability to make die casting help solve design problems has proved a service extra for hundreds of customers. When you design for die casting write, wire or phone Twin City Die Castings Company. Chances are, a Twin City engineer can make die casting solve design problems for you.

...only DIE CASTING can
✔ cut your costs ✔ offer such flexibility
✔ provide such accuracy

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If it's accuracy you're after, *call a Hoover Man*

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THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio
In Canada — Hamilton, Ontario

Die Casting specialists since 1922

DIE CASTING *by* HOOVER

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APEX 39-11

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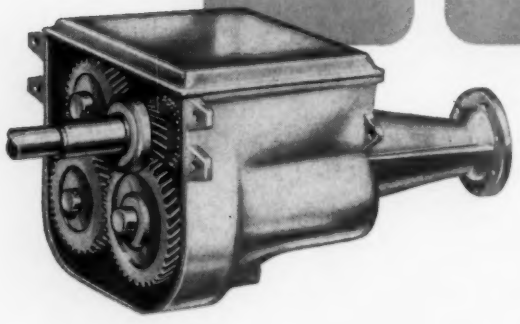

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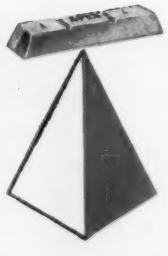

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Shows composition, properties, other data on Apex products.
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